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ABSTRACT

Activities in the life and physical sciences are provided (in separate sections) for preschool and elementary school students. Life science activities include those related to plants, soil, habitats, fossils, animals, life cycles, food chains, nutrition, and other biologically-oriented topics. Physical science activities include those related to matter (solids, liquids, gases) and energy (motion, sound, light, heat, electricity, magnetism). Objective(s), materials needed, instructional strategies, and a section with additional information for teachers are provided for each activity. Various aspects of teaching science to young children are discussed in an introductory section. A final section includes: (1) activities focusing on the nature of experiments; (2) measuring activities; (3) lists of books and science suppliers; and (4) a materials packet containing sheets to reproduce for selected activities. (Author/JN)

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SCIENCE ACTIVITIES FOR CHILDREN 3 TO 9 YEARS OLD

BONNIE E. NELSON

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SCIENCE ACTIVITIES

FOR CHILDREN 3 TO 9 YEARS OLD

BONNIE E. NELSON

With illustrations by Elvira Ferrario, the author, and science suppliers

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PUDDLES, PODS, AND PAPER: SCIENCE WITH YOUNG CHILDREN

Young children are natural scientists. What Montessori calls their "instinctive search for knowledge" leads them to see, hear, taste, touch, smell, and manipulate objects in their environment. Young children's needs for concrete experiences--to explore and manipulate--are total. They don't merely look at puddles, they walk in them, sit in them, taste them, splash them, mix dirt in them--they experience the effects of puddles from sodden hair to misshapen shoes. This is how they "construct themselves," how they assimilate knowledge. Alas, adults do not always understand the intellectual significance of a joyous celebration of puddles.

One of the best ways we can help young children gain what Montessori considers the sensorial foundations of intellectual development (what Piaget calls "physical knowledge") is through early science experiences. Aside from leaving them in their puddles, how do we provide science experiences for pre-school aged children at home or in a classroom? Somehow their first "messing around" stages and their later elementary age maturity make it seem clearer what science experiences are. In this day of asphalt, fast food and TV relationships,

just understanding what is real may be a major scientific achievement. Many young children have every reason to believe that margarine containers talk, that chocolate grows in Brooklyn, and that carrots hatch in plastic nests at the supermarket.

KING KONG

3 year old: Ethan says Ting Tong is real.
My Daddy says Ting Tong is not real.
You think Ting Tong is real?

8 year old: Nah, he's just a funny ape.

To further complicate matters pre-school children are in what Piaget characterizes as the "pre-operational" stage of development (roughly ages 2-7). This means they are non-logical, ego-centric, and perception-bound. They do not know that the same ball of clay has "just as much stuff in it" when it's flattened out. They cannot conserve, and their view of causality is often a mixture of God, magic, and poetry:

(1) "God did it." (attributes cause and effect to God)

(2) "The rock wanted to crumble." (animism)

(3) "When I go to bed, the moon comes out." (ego-centrism)

My first efforts to provide science experiences for classroom children (ages 3-6) were remarkably unsuccessful--even the nature walks to collect fall leaves. Taking 24 young children on a long walk to a city park has discouraging moments. But even more discouraging were my conclusions about the

scientific nature of this experience. One child complained that her hand hurt. Two continually announced how much they didn't want a walking partner, another used a leaf branch to annoy her partner. Three were angry that "Johnny got more leaves," and the youngest who'd been in school only four weeks was sure he'd never see his mother again. From their conversations, I gathered that the high point of the walk was watching a bum urinate on a park statue. Some of the leaves preserved in plastic contact made a nice matching and labeling exercise. I felt good about this until I noticed how few children used the exercise.

The next year we took more walks, had more discussions, and contacted the leaves before and after the color change. These second-year activities did catch the interest of more children, but I was not often pleased with the quality of these concrete experiences or the degree of interest exhibited by the children. "It would be easier if we lived in the country," I complained. Gradually I found my interest in leaves and my convictions about the importance of concrete science experiences were turning into discouraged, hassle-bound responses. One fall I actually thought,"Oh no, we have to take those leaf walks again."

Believe me, this is no way to teach science--especially since a teacher's interest and enthusiasm are such important factors in successful science experiences.

Now some years later, after I learned a few things--not the least of which is how to observe children--my classroom is alive with science experiences. Many math, sensorial, and art activities grow from science activities. Half the geography shelf could well go on the science shelf. Many science activities actually do go on the practical life shelf. I can even foresee teaching an entire language curriculum based on science activities. And to help matters along--I love it--most days that is.

We solved our leaf walk problems by adopting a tree near the school. The year we adopted a honey locust tree taught me just how long it takes some children to really see what they see. Day after day the children collected the large seed pods. They rattled them, discussed them, threw them, broke them, smelled them, glued them, counted them, labeled them, measured them, compared them, and sang about them. A few even learned how to take off their coats with fists full of them. One day when the locust pods were crowding sidewalk, playground, lunch boxes, and the show-and-tell table, one 3-year-old picked up a pod and went about joyfully proclaiming this new thing she'd discovered.

"The processes involved in discovery are as important as the discovery. You cannot hurry inquiry or discovery."
G. Blough
J. Schwartz

Through all the seasons, with collections, photographs, songs, etc., an adopted tree can easily become a part of the science curriculum. The younger children especially enjoy bark rubbings. Many of the oldest children choose activities involving language--labeling, describing, writing, or reading. A child too absorbed in something else to care about the tree today, may well care about the tree tomorrow. Since they walk past it frequently, it gradually becomes part of their consciousness.

Including activities with the adopted tree, I have written up over one hundred science activities for young children that actually work in my classroom. Some of these activities were suggested by the children. All too many started as failures--usually because I'd read a science book intended for older children. Texts for older children and for teachers of elementary science can be sources of ideas, but actual classroom activities must be changed or adapted for the cognitive and motor skills of young children. I also found many good ideas in nature guides, children's books, and books on single subjects like rocks, sea shells, leaves, etc. With a few notable exceptions, I did not get many ideas from books actually written for teachers of young children; these usually contented themselves with theory, vague generalities, and suggestions like, "Take them on leaf walks."

These science activities which I have written up--usually in detail--reflect what I have learned about how

young children learn science and how teachers can keep a classroom continually alive with science experiences.

Perhaps, the most important thing I've learned about young children is that their initial response to new experiences is seldom "WHY?" When Fluffy, the guinea pig, died, the lower school children responded: "Fluffy is dead! He can't move! He's just there in his cage. Oh, let's tell John." Only when the upper school children (ages 6-10) arrived did the question of why Fluffy died come up. Young children are less concerned with facts and whys and are more concerned with processes. Science for them is observing, classifying, exploring sensorially, and communicating. They learn to measure, to count, to compare. They discover patterns and relationships. They enjoy and learn from simple experiments. They love to predict. If their motor skills allow, they struggle hard to write or otherwise record their experiences. It's even possible that science is the best way for young children to learn to read.* With their interest in language and love of new words young children talk happily of "stomata," "rectangular prisms," and "nocturnal animals." They do learn facts too, but it seems they learn less and care less when facts are the teacher's goal.

*See J. Barufaldi and J. Swift, "Children learning to Read Should Experience Science," The Reading Teacher vol 30, no. 4 (Jan. 1970).

"Adult society looks for the 'competence" of the child without understanding his need for a preparation time in constructing and building up his faculties"

L. Wikramaratne

So you may wonder, how does a teacher become a patient, superperson science source? How does a teacher walk with dignity around puddles on the floor to explain that "Hamsters are not for poking," and "Well, baby radishes probably don't get lonely at night." How does a teacher keep a balance between structured and unstructured activities, between children's needs to "mess around" and explore in their own way and their need of adult intervention to help them experience and understand more? In one minute this teacher talks with a 6-year-old who has built her own terrarium and may even have a rudimentary knowledge of the process of evaporation and condensation. In the next minute this same teacher faces a cherubic weather announcer who solemnly declares, "It's 3 degrees and partly today."

To further enliven matters, the failure or success of some science activities seems at times inexplicable. The same activity can keep their attention for long periods or bore them thoroughly depending on whether it's presented as a nature walk, a small group activity, or an individual work choice. The personality of the class as a whole affects interest, too. One year rocks are a "hot" item. The next

year only a few children find them interesting. Meanwhile, some off-hand remark you've made to one child has turned large numbers into explorers in search of liquids and solids. True tragedy is to sit there musing on how to interest them in rocks and miss their argument over whether jello is a liquid or a solid.

To become this super teacher of science you first choose one thing <u>you're interested in</u> and put it down somewhere in the classroom. Watch what happens. If no one takes an interest in it, you invite them and model your own interest. Take liquids and solids for example. Let's assume for now that they've had many chances to explore water outside of bottles. The first day you invite them to watch you fill pretty bottles and containers with colored water. A long, corked plastic tube is nice because they can watch the bubble

"Their sensitivity to the life cycle is real; very close. The right kind of exposure to nature and the related sciences will be indispensable to developing a keen sense of reality and purpose."

D Kahn

go up and down. Just shake and tilt the bottles and tubes. Talk little at this point. They first need to explore sensorially and handle on their own. The next day (or several days later) introduce the word "liquid" and write it. (See pages in Physical Science Section for detailed descriptions of all liquid-solid activities mentioned here.) Compare liquids and solids; wipe up one and pick up the other. Do the classification exercises. Play the liquid-solid game. Keep going if the interest is still there. There are even possibilities for creative dramatics and a liquid-solid dance.

The cycle of presentation is from sensory experience to language, from concrete to less concrete, from silence to words and games. Your group consists of those children who are interested and respond to your invitation to keep going. Some littles drop out when you start classifying. Some never take an interest at all. Many 4-year-olds love the labeling and games. They all love making butter. But now you're going to make a booklet. Put out the booklet, invite them and make the booklet only with those still interested. Chances are many 5-year-olds will be interested, a few 4-year-olds, and one 3-year-old who can't read her name or hold a pencil. Now you don't have to invite the 3-year-olds to this final more abstract stage, but if you did, don't renege on the invitation just because you didn't plan on a response. Take the 3-year-old on your lap and share your booklet with her.

All of you make and discuss the booklet together. In your booklet the 3-year-old does the coloring (and hopefully some listening) while you do the writing. Later put the booklet and pages on the shelf for individual work choice. Some children return to make the same booklet over and over; others may not be interested in making the booklet till later--if ever. Some who cannot write want to illustrate or trace teacher-made booklets.

This is one way to present anything from rocks to air. Two rules are important though. One is stop...let it go...put it away when no one shows an interest or even bothers to touch that rock or bottle of water. Do not waste your time or theirs pulling teeth or trying to make booklets about things they've barely noticed. Second, do not, as time goes by, load up the first simpler activities with so many labels and language activities that the sensorial explorers are afraid to go near that rock or bottle of water. Put the labels or sample booklets on another tray. The budding writer-reader can take the rocks as well as the tray of pencils and labels to a table. At another time the concrete explorer can take only the rocks to a table. Now the explorer doesn't have to worry about those word-cards or have to chew on them while trying to make sand.

"Sand comes from rocks.
The rocks bump around.....
and bump around some more.
Then little sands come out."
4-year-old

One final, practical note--to do more than just an occasional science activity, you need to develop good classroom management skills. If your shelf space is limited, buy a low, plastic parson's table, and set it up near a water source. Each week set up a different science activity on the table. If the activity is especially complex or messy, place on the table top a plastic mat with markings outlining where equipment goes. Think through the skills that the children will need for a given exercise. Before putting in an activity with eye droppers, for example, give them plenty of practice using basting syringes and droppers of varying sizes. Because my classroom is a Montessori classroom, I spend a lot of time showing children how to pour, carry water, use a sponge, turn a screw driver, etc. All the practical life activities which fascinate young children also enable them to do more science activities independently.

Many of the activities described in the following pages can work as individual activities or for small or large groups. Facts provided in "Additional Information for Teachers" are usually not for the children, certainly not for younger children uninterested in "Why?" These facts are for your personal orientation and you have to decide how much is for the children's use. Keeping in mind the purpose of an activity is important, too. The egg and vinegar experiment, for example, is used to teach what an experiment is--not what effect acid has on calcium. Keeping the purpose in mind, you can adapt these science activities to most classroom situations.

I do not know what I may appear
to the world; but to myself
I seem to have been only like a
boy playing on the seashore, and
diverting myself in now and then
finding a smoother pebble or a
prettier shell than ordinary,
whilst the great ocean of truth
lay all undiscovered before me.

Isaac Newton

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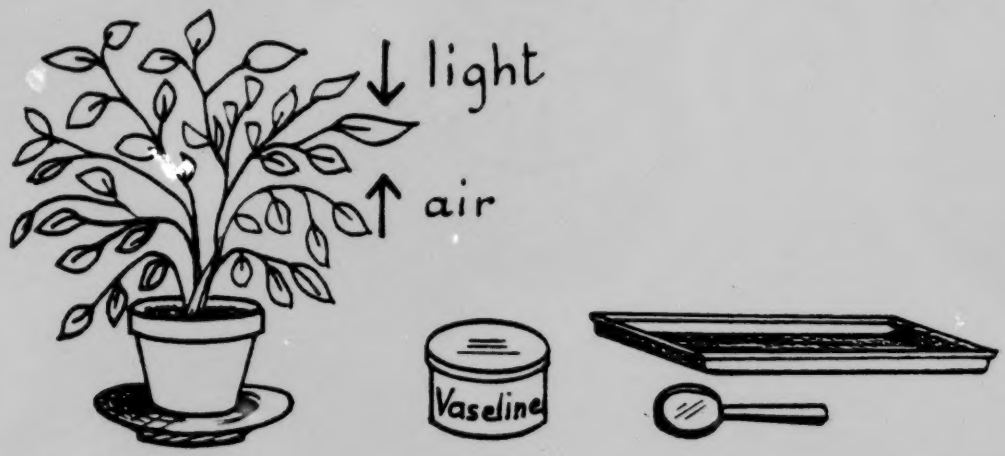
Life Science



TOPIC: How plants "breathe"

OBJECTIVE: to observe and compare top and bottom of a leaf, to conduct an experiment, to understand that leaves must have air in order to live; new word--stomata

MATERIALS: vaseline, plant, magnifying glass, tray

PRESENTATION: The teacher does the experiment while the group watches.

TO DO: Put vaseline on top of two leaves and on underside of two leaves. Two days later compare and discuss. The leaves coated on the underside will be dying. Take off a healthy and a dying leaf and put on a tray with a magnifying glass for children to inspect.

ADDITIONAL INFORMATION FOR TEACHERS

A plant "breathes" through openings called stomata on the bottom of its leaves. Leaves take in air containing carbon dioxide. Vaseline prevents this and the leaves die. The top of the leaves take in light. The vaseline does not prevent light from coming in, so these leaves do not die.

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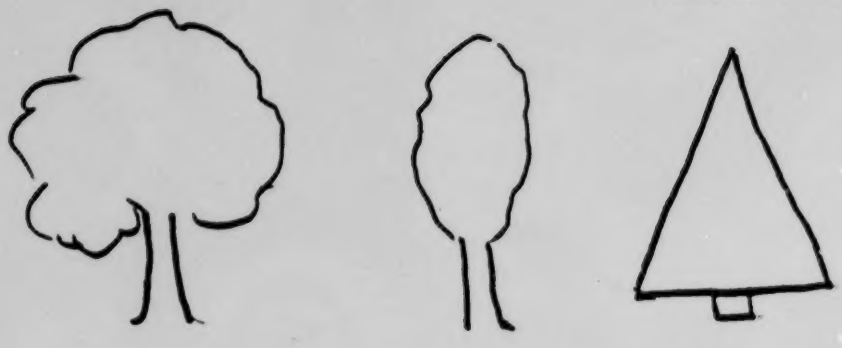

TOPIC: Adopt-a-tree

OBJECTIVE: to enjoy and learn all they can about one tree near the school, to experience that tree in all seasons and to record these experiences; to make collections

PRESENTATION: The teacher should choose an interesting, deciduous tree as close as possible to the school. The teacher will gradually become knowledgeable about this tree. To begin, however, all (s)he need do is choose the tree, find out its name and introduce it to the children.

TO DO:

(1) observe, touch, smell

Observe, touch, and smell the tree together. Tell children its name. Invite them to stroke the bark, observe the leaves and general shape of the tree. Notice if any animals live there.

(2) sketch, label

Sketch for them an outline of the tree's general shape (see illustration at top of this page). Make a label of the tree's name which they can copy.

(3) Photograph

Take a picture of the tree (with children standing around) in all seasons. After summer and fall pictures are taken,

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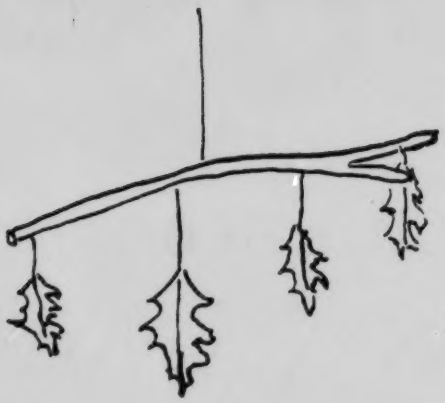

leaf mobile

display them and introduce a new word--deciduous. Our tree is deciduous. That means it loses its leaves."

(4) fall leaf mobile

Choose and save leaves from summer and fall. They can be encased on both sides in plastic contact and pressed under weights. Use contacted leaves to make a mobile. Suspend leaves from a bare branch. A few leaves will dry too much and have to be replaced from the extra ones contacted in early fall. The mobile will last till winter and be quite beautiful as the branch and leaves rotate gently.

(5) leaf prints

Make a crayon rubbing or an ink pad print of the leaves. To make an ink print:

(a) place leaf on an ink pad (bottom of leaf down)
(b) press newspaper against leaf and rub
(c) remove newspaper and set up a piece of plain paper near
(d) pick up leaf with tweezers and place on plain paper
(e) place another sheet of plain paper over the leaf and rub over leaf without moving it (hold covering sheet with one hand while rubbing with the other hand)

(6) booklet of leaf color changes

In fall when leaves turn colors, tell children that now the tree is cutting off all water and food to the leaf--that's why the leaf changes colors. Show them the scar on the twig

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where the leaf separated. Compare a fallen leaf with one still on the tree. Which is drier? Make a booklet for children to color and label that shows leaves in summer and fall. (See illustration above.)

(7) falling leaves (drama and chanting)

Watch the way leaves fall from the adopted tree. Do they float like a tiny glider, or spin as they drop? One chant appropriate for a circle activity is "Five little leaves." Five children stand in the circle pretending to be leaves while others sit, chanting and pretending to be the wind.

Five Little Leaves

Five little leaves so bright and gay
Were dancing on a tree one day.
Along came the wind.... woo....woo
And blew them around
And little leaf _____ (child's name)
came tumbling down.

The child whose name is called, flutters down and joins the seated children on the circle. Repeat the chant five times until all leaf-children are blown down.

(8) twigs

Collect a few twigs from the adopted tree; label and mount them. Identify leaf scars, pith and lenticels (optional).

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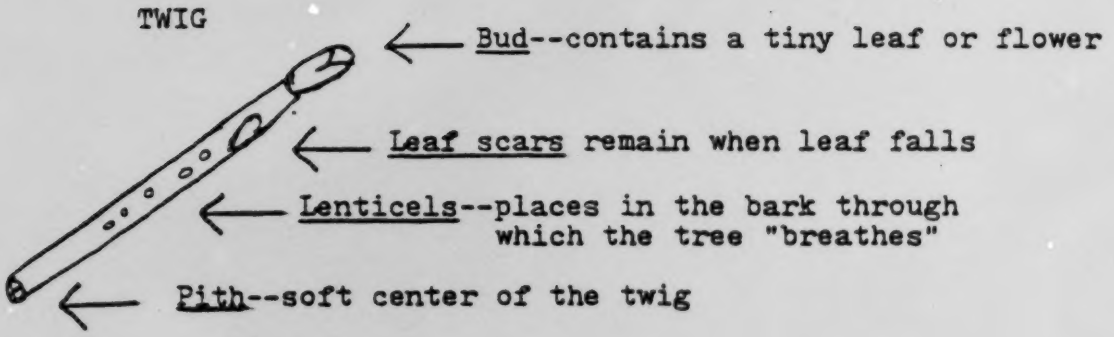
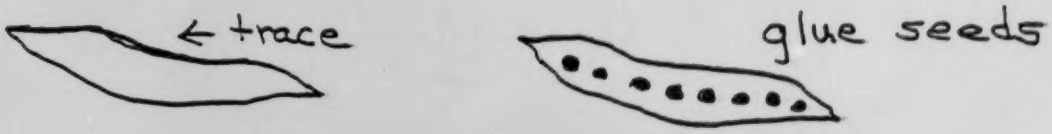

TWIG
Bud--contains a tiny leaf or flower
Leaf scars remain when leaf falls
Lenticels--places in the bark through which the tree "breathes"
Pith--soft center of the twig

(9) seeds

Collect seeds from the tree. Explain the function of a seed (best done by letting them plant a lima bean or sunflower seed). Find tiny shoots from tree seeds that are just starting to grow. If possible use parts of seeds as a collage. One interesting way to arrange seeds is to make a cardboard outline of what the seed case (if there is one) looked like before it disintegrated. After tracing this outline, the children could then glue seeds inside the pod outline on the paper. Below is an outline of a honey locust pod filled with seeds from the pod.



Discuss how seeds travel. Compare methods of travel with seeds from other trees nearby. A nice game with winged seeds is to drop various kinds from the same place on a windy day; see which one goes farther (measure distances). See section on "Air and falling objects" for description of how to make a helicopter; maple seeds spin like helicopters as they fall. Seeds can be collected and classified according to how they travel. Here are a few examples of seeds that fly on the wind, roll over the earth, float on water, and even hitchhike.

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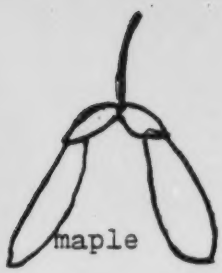
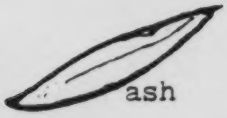
Maple
Ash
Elm


maple


ash

When the wind blows, these seeds sail through the air as if on wings. Maple seeds twirl like the blades of a helicopter. Slippery elm disc-shaped seeds can fly like a frisbee.

Cottonwood
Willow

cottonwood

These seeds have fluffy white parachutes of cotton. Wind carries them far away.

Honey Locust
Pines
Witch Hazel

locust pod

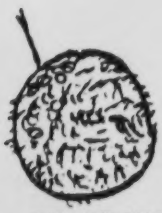
Heavy pods or cones split open and seeds spill out. People who carry pine cones home for decoration are helping spread seeds about.

acorn

Oaks
Nut and Fruit Trees

Seeds are eaten, buried and carried about by animals.

Sycamore
Sweetgum


sycamore

Round ball-shaped seeds can roll easily. Seeds catch easily in animal's fur.

Cypress
Palm

coconut

Seeds float in water. Coconuts can float from one ocean to another; the covering husk is like a life-jacket.

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bark rubbing

paper

fat crayon

(10) bark rubbing

Have children in small groups (2 can work at once) make a bark rubbing. Tape or hold a piece of white paper against the tree trunk. Rub a fat black or brown crayon on its side against the paper. Label. Notice how bark of trees differ.

(11) song-poem

Make up a song or poem about the adopted tree. Read poems and songs about trees.

(12) books, album

Collect books and pictures about the adopted tree. Make an album or wall poster of all adopt-a-tree activities done by the class.

(13)take advantage of the unusual

If a storm uproots a tree, make a visit. Take special notice of the tap root and smaller roots. Ask workmen if they will cut 2 inch slices (in decreasing diameters) from various parts of the tree for you. If a snow storm damages or overloads the boughs, take a picture and write a story about what happened. Be ever alert to what happens to trees nearby. Why does the electric company cut off their tops?

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A TREE FOR THE BIRDS

TOPIC: A tree for the birds

OBJECTIVE: Why not celebrate December in a non-sectarian, energy-conscious way? Feed the birds and at the same time model for children a joyous way to celebrate and decorate in ways that benefit our earth.

MATERIALS: Buy a tree to plant later, use a living tree nearby, or set a discarded tree limb upright in a large container of dirt. Children can bring from home or make in class appropriate items to hang on the tree.

TO DO:

(1) String raisins, popcorn, and cranberries.
(2) Hang dried corn from limbs or tie it down on a branch.
(3) Make pine cone treats. Dip cones in melted suet and sprinkle with wild bird seed. Harden in refrigerator and tie to branches with colorful ribbons.
(4) Hollow out large potato, and fill with blend of melted suet, cornmeal and grain. Wire potato to branch.
(5) Tie sheafs of grain to tree limbs with a decorative bow.
(6) Suspend gourds or coconut shells filled with cranberries, sunflower seeds, or popcorn.
(7) If tree is dead, bore holes in trunk and branches and fill holes with suet-seed mixtures. If tree is alive bore holes in

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small logs, fill holes with suet mixtures. Drill hole through one end of the log and hang the log by a rawhide lace.

CAUTIONARY NOTE

If wire hangers are used, cover the wire with mystic or florist's tape so the bird's feet won't stick to it in cold weather.

PUBLICITY NOTE

If you'd like some publicity, call local TV and radio stations. Invite newspaper reporters over, or send a news release with large black and white glossy pictures of children decorating the tree and making the decorations.

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A TERRARIUM

A terrarium is a place where plants and/or animals can grow in surroundings similar to those found in nature. Find a glass or plastic container. Choose plants that like similar conditions of moisture, soil, and light. Some experimenting may be necessary to find the right combination of plants. You can buy plants, use your own seedlings, or collect weeds that don't grow too fast. Ferns and mosses grow especially well in damp conditions. Avoid using lichens or fungi in environments for ferns and mosses.

PLANTS YOU CAN USE

African violet
Angel plant
Aluminum plant
Arrowroot
Baby tears
Begonia
Dumb cane
Dwarf palm
Ferns (Asparagus, Bird's nest, Holy, Maidenhair, Victoria)
Gold dust plant
Gold thread
Ivies, small leaves
Lichens
Mosses
Parlor palm
Peacock plant
Philodendron
Prayer plant
Rattlesnake plantain
Wandering Jew
Weeds--any that don't grow too fast
Wintergreen

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TO SET UP A TERRARIUM

(1) Clean the container thoroughly.
(2) Cover bottom of container with 3 cm of gravel or pieces of broken flower pots.
(3) Sprinkle very thin layer of potting charcoal over gravel.
(4) Next add 5 or more cm of rich soil.
(5) Add plants. If terrarium is viewed from only one side put taller plants in back. If it will be viewed from all sides, put taller plants in middle. Anchor plants firmly so that no leaves touch the glass.
(6) Rocks, bark, or a small hill can add interest. To make a home for salamanders sink a rust-proof dish of water into one end.
(7) Water moderately since over-watering can cause plants to mold. You can always add more water later if plants start to wilt.
(8) Cover the terrarium with glass, but allow small opening for air circulation. If too much water condenses on the inside glass, increase the opening at the top. The terrarium needs no water as long as moisture beads on the inside.

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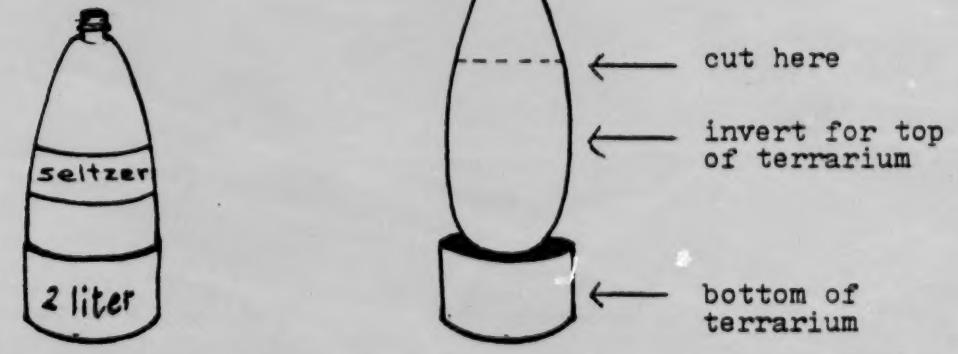
HOW TO MAKE AN INEXPENSIVE MINI-TERRARIUM

Ask children to bring in large plastic 2-liter drink bottle containers. The bottom of the container must resemble a bowl.



Soak bottle in warm water. Labels come off and bottom bowl part can be dislodged by pushing in sides of the bottle. Cut bottle above place where it tapers in.

MATERIALS: soil, gravel or crockery pieces, potting charcoal, 2 or 3 small plants, 2-liter drink bottle prepared as a terrarium (see above).

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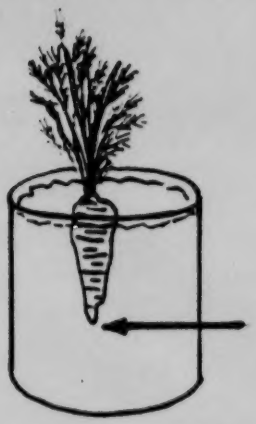
TO DO:

(1) Fill bottom of bowl with 2 cm of gravel or broken pieces of crockery.
(2) Sprinkle on top a very thin layer of potting charcoal.
(3) Fill bowl 3/4 or more with premixed potting soil.
(4) Put in 2 or 3 small plants and fill bowl to top with soil.
(5) Anchor plants firmly so that leaves do not touch edges of the container.
(6) Water moderately.
(7) Fit bubble part upside down over the bowl and push down until it fits. Tape in place.
(8) When moisture no longer beads on the inside bubble, place the terrarium in a bowl of water so that water can be absorbed through holes in bottom of the bowl.

ADDITIONAL INFORMATION FOR TEACHERS

Encourage students to try different types of environments. One terrarium might have cactii and sandy soil. Another could have moss and a small fern in a very moist environment. Others might have weeds and various plants found in the immediate environment of the school. One terrarium could be moved to various locations in the class to see if it thrives best with or without sunlight, near the radiator, next to a chilly door, etc. If display space is limited, children can take their terrarium home as others bring in more bottles.

Little Finger Carrot



LITTLE FINGER CARROTS grow 9 centimeters deep in 65 days.
Order from Burpee Seed Co., 300 Park Ave., Warminister, PA 18991

TOPIC: Carrots in a flower pot

OBJECTIVE: to watch a carrot grow; to harvest and eat a root vegetable; to understand that roots grow down, hold a plant in place, and provide food and water.

MATERIALS: Little Finger Carrot seed, flower pot at least 9 cm. deep, potting soil (or compost made by the children),gravel or pottery pieces for drainage

PRESENTATION: Teacher or older child plants seed while group watches. Later teacher gives all interested children seeds to plant at home or at school if space permits.

TO DO: Put gravel or pottery pieces in bottom of pot for drainage. Fill pot almost to top with soil. Put 4 seeds in 3 separate clusters near center of pot. Cover with 1 cm of dirt. Water. Place pot where it will have direct sunlight at least 2 hours a day. When small shoots are 3 cm high, weed out all but 1 from each cluster. Later (about 65 days) when carrots are mature, loosen soil around 1 carrot before pulling. Let children watch or help pull it out. Tape the carrot on a poster and label stalk, leaves, root, and root hairs.

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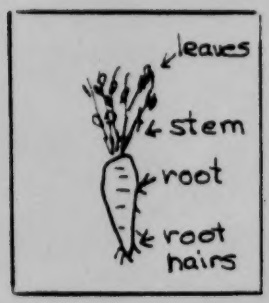

CARROT POSTER

Tape a real carrot on a piece of cardboard.

Loosen all dirt around second and third carrot and place pot on floor. Invite children to pull and replant these 2 carrots all day. At end of day children may scrub and serve small slices of the carrot to each class mate.

ADDITIONAL INFORMATION FOR TEACHERS

Many children--especially in the city--do not understand that carrots grow underground or that people eat roots. After planting and harvesting the carrot, other edible roots could be brought into class. Raw beets, for example, are fun both to scrape and to eat.

Three-year-old: "Do baby carrots miss their mommy at the supermarket?"

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TOPIC: Sprouting

OBJECTIVE: to watch seeds germinate, to discuss their nutritional value, to taste and enjoy them

MATERIALS: one pack of three plastic sprouting lids (available in many health food stores), one jar that the sprouting lid fits on snugly, three tablespoons of mung beans, water pitcher, sponge

PRESENTATION: Teacher demonstrates and leaves on shelf for children to choose. The best set-up is on a small, low table at which children may stand while pouring water into the beans.

TO DO: Soak beans over night and put in jar. Choose lid of smallest mesh and push down tight. During the presentation (if you're not using the separate table set-up), make one trip carrying only the jar with both hands. Make another trip to the shelf to get a tray with a sponge and pitcher. Fill an 8 to 12 ounce pitcher 3/4 full. Pour water into jar through the mesh top. Take sprout jar to the sink and hold upside down till all water is drained out. Emphasize that the top stays on the jar. Return jar to shelf or table.

ADDITIONAL INFORMATION FOR TEACHERS

This is one of the simplest, least problematical methods of sprouting. Mung beans are very easy to sprout. Children may water them all day and it doesn't harm the sprouts. Change to larger mesh lid as sprouts get larger. Over the weekend leave 1/4 inch of water in bottom of the jar.

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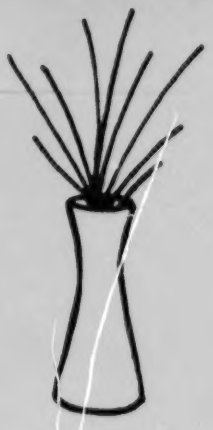
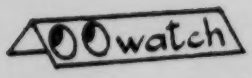


1.



PUSSY WILLOWS

(1) Put bare stems in water and let children watch buds open.

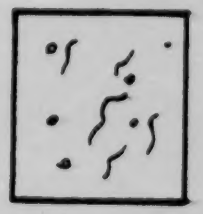
2.

(2) When buds open, pass stem around. Let each child pick 1 bud to rub on a cheek Discuss soft and fuzzy.
New word: pussy willow

(3) Label and put remaining pussy willows on an art table. Invite children to make a pussy willow collage by drawing black lines and by gluing small balls of cotton on brown paper.

(4) After 6 weeks or more, strip off remaining buds. Cut stems into two inch pieces. Children can collage with these pieces in any fashion they choose.

4.



buds + stems.

TOPIC: Recycling and making compost

OBJECTIVE: to experience making something useful from waste materials; to understand that they can make soil from things thrown away at home; new words: recycling, compost

MATERIALS: coffee can, coffee grounds, newspaper, dried leaves, apple peel, orange, any dried cereal, seeds, water

PRESENTATION: This is best with a small group. Three or four children can share a can. An adult or older child who can read needs to be in charge to see that pieces are shredded properly.

TO DO: (1) Save coffee grounds from morning's coffee. Put in the bottom of an empty coffee can. (2) Shred large sheet of old newspaper into tiny pieces and put in can. (3) Break orange peels and apple peels into small pieces and add. (4) Add a handful of dried, crushed cereal and maybe a handful of dried crushed leaves. (5) Stir well and moisten with water. (6) Cover can. Punch three small holes in the top. Let can set in a warm place for four days. Each day look inside and smell. On the fourth day feel the outside of the can. (7) On the seventh day stir up the soil and plant some seeds in it.

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TOPIC: Soil

OBJECTIVE: to observe soil closely and name what is found in it, to compare and contrast what happens to objects in moist soil, to conduct an experiment; new words — biodegradable, rot

MATERIALS: potting soil or compost made by children, 5 or more wide-mouth glass jars, objects such as glass, aluminum foil, plastic, bread, leaves. Magnifying glass, several trays or shallow bowls.

PRESENTATION: small group project

TO DO:

(1) Rotting paper

Fill jar with potting soil and add enough water to make mud. Lay paper on top soil. Close jar and put in a warm place. After 1 week open jar, examine paper. Discuss meaning of "rot." Repeat using leaf or thin slice of fruit.

(2) Soil and magnifying glass

Examine soil with magnifying glass. Invite children to bring soil samples from wood, lawn, pond, bank, sea shore, etc. Put samples in bowls on a tray and examine with magnifying glass. Name and list things found in soil. Keep small baby food jar samples of different colors of soil; label with location of where soil was collected.

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(3) Biodegradable and non-biodegradable objects

Bury different objects in jars of soil. Put jars in a warm place and keep moist. After one week dig up the objects. Compare and contrast. Bury objects again and dig up in two weeks. Try to pull buried objects apart. Which ones seem to be rotting and turning back to soil? "These are biodegradable."

(4) Make compost

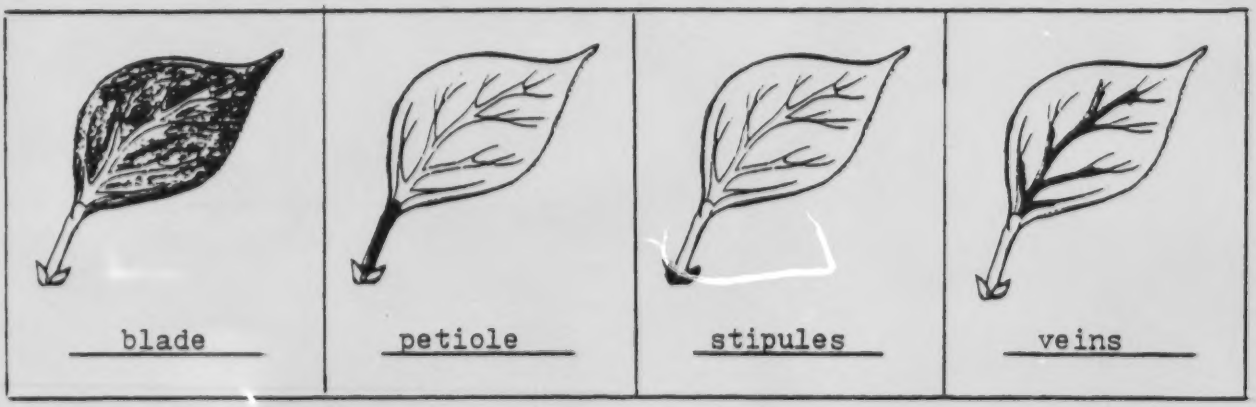
See activity in this section called "Recycling and making compost."

PARTS OF PLANTS BOOKLETS

Make isolation booklets for parts of plants. See example below of how to label and color a 5-page booklet. Wall paper makes attractive covers for these booklets. Children especially enjoy isolation booklets if they first experience the real plant. These booklets should be viewed as an abstract language extension of a previous sensorial or concrete experience. If the child cannot write, (s)he colors in the parts, and the teacher writes the name.

How to make an isolation booklet

Label and color (using colored pencils) the entire leaf on page 1. On successive pages label and color one part per page. To finish, the child chooses 2 cover pages and staples all pages together with back and front cover. Teacher provides model pages for child to copy.



Pages for parts of plants and animals can be ordered from:

Montessori Services
C/O Jane Campbell
Box 249 RD 1
Glen Moore, Pa.
19343

and

Designed for Children
Box 271
Kent, Ohio 44240

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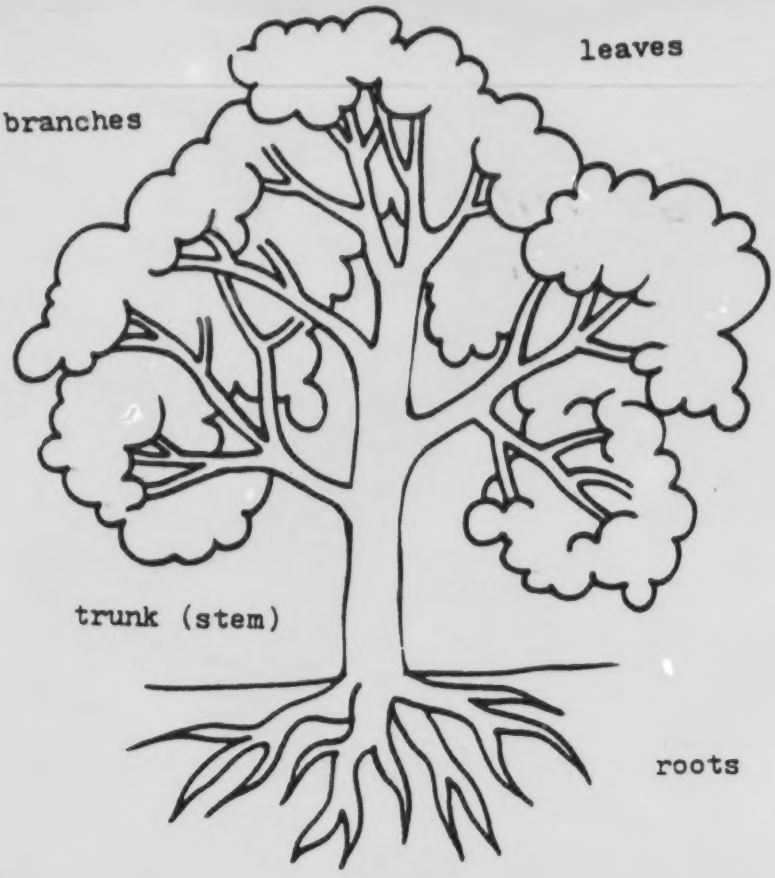
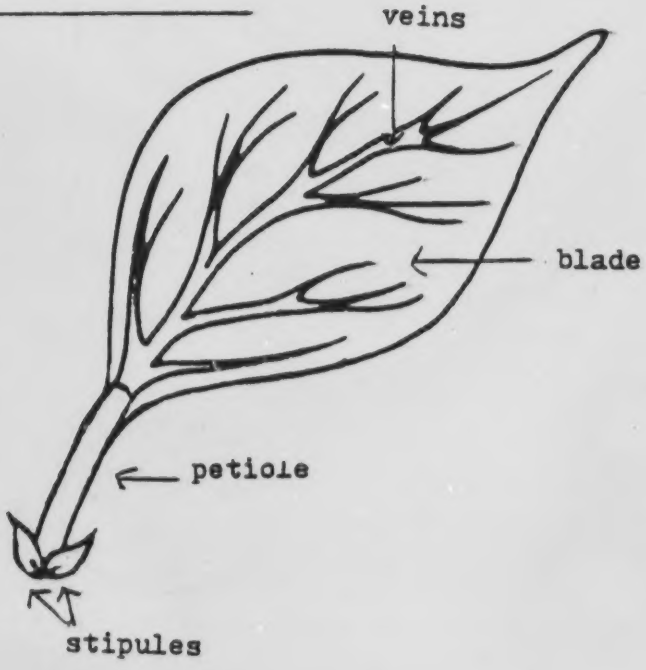


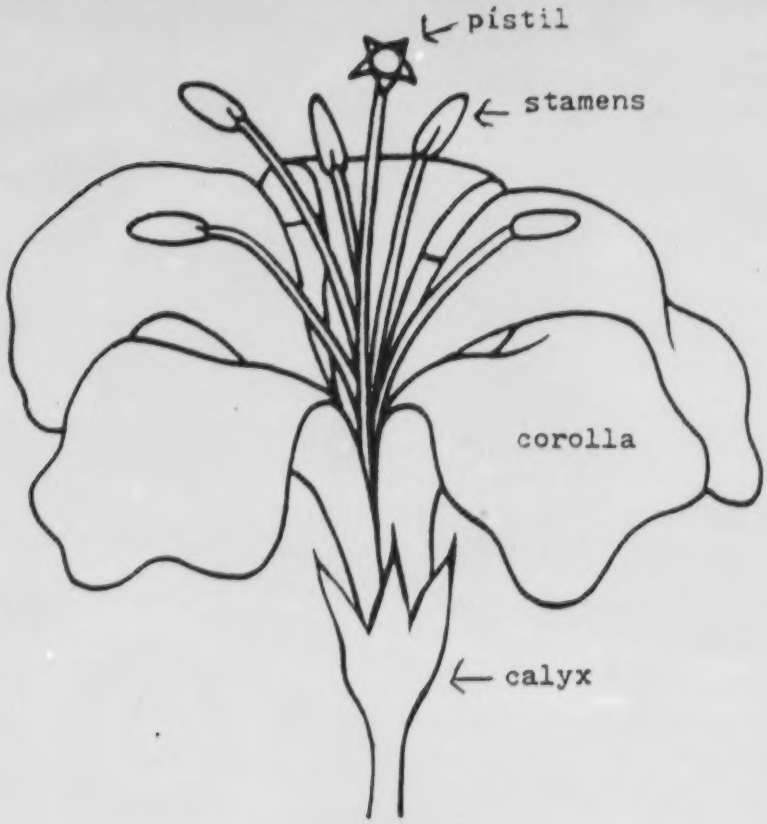
Make a 5-page booklet for parts of a tree

tree



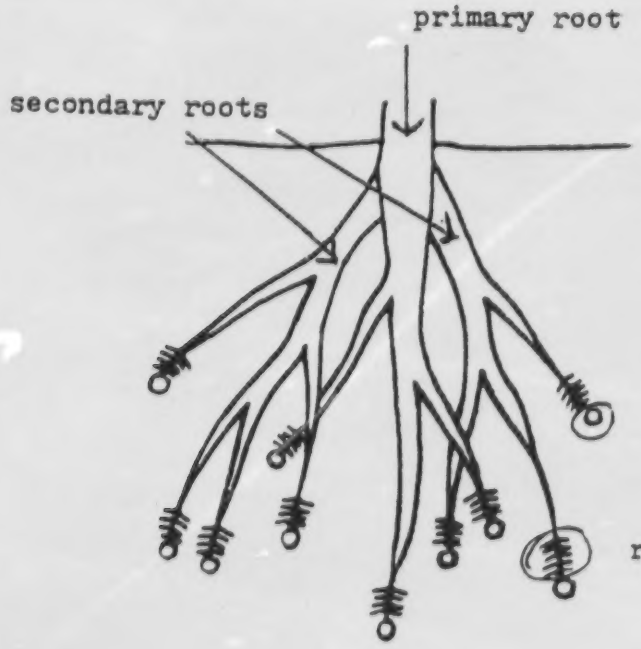
Make a 5-page booklet for parts of a leaf

leaf



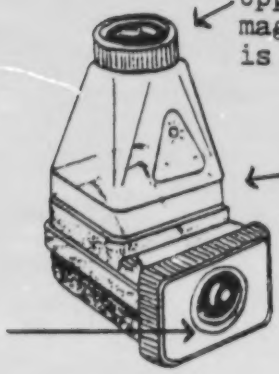
Make a 5-page booklet for parts of a flower

flower



Make a 5-page booklet for parts of a root

root


Upper lens has slight magnification. No focusing is required.
Inside is bowl for live specimens. Occasionally spiders have built webs inside our microscope.
Lower lens allows children to see bottom of specimen.

TOPIC: Microscope for young children by Semper
"Little Learner Experiment" series can be ordered from Childcraft (order number N625) for about $11.

OBJECTIVE: to observe plant parts and small animals under a microscope, to understand what a microscope is and to use it regularly and spontaneously as the children discover or bring in specimens, to enjoy observation of live specimens without killing them in the process, to make a ritual of setting free live specimens at the end of the day.

MATERIALS: Semper microscope, index card, table mat, scotch tape, low table about 60 cm (2 feet) high, specimen

PRESENTATION: Teacher puts specimen in the microscope and leaves it on a low table for children to look at. Because this microscope allows for observation of live specimens, even brine shrimp moving in water, it is wise to have strict and consistent ground rules that protect the live specimens. Even though the microscope could be picked up and tilted if the specimen is dead, this is not a good thing to model. Very young children cannot always remember whether the specimen is alive or dead. It's simpler if the microscope is always used

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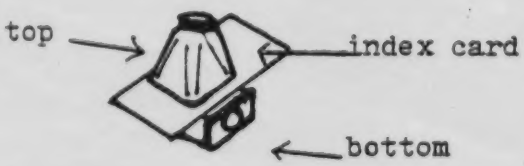
in the same way. The first presentation of this microscope each year should be quite formal--perhaps a silence game first to quiet and focus the children.

TO DO: Put specimen in center bowl and scotch tape two sides closed. Place microscope on mat on small table. Silently and slowly dramatize how to look into the microscope. Hold hands behind your back and slowly lower one eye to the top of the microscope. Briefly describe what you see. Next squat beside the table and look into the side viewer of the microscope. From this side lens you can see the underside of the animal. This is an especially interesting view of a live caterpillar as it undulates about. If possible put food in the microscope bowl for live specimens, e.g., a leaf for the caterpillar, a fly for the spider. Release live specimens at the end of one day. Sometimes--if a spider is building a web--we have kept it in the microscope for two days.

It is easy to capture live specimens if you use this method. Put the top section of the microscope over the animal like this.

Slide an index card under the animal, pick up and put over the microscope bottom like this.



Slide the index card out slowly so that the specimen goes into the bowl of the microscope bottom; at the same time close the

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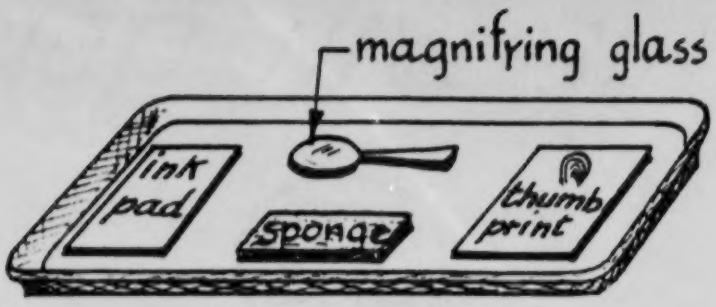
microscope top over the bowl. Scotch tape the top to the bottom on two sides so that children cannot accidentally let the specimen out.

ADDITIONAL INFORMATION FOR TEACHERS

I highly recommend purchasing this microscope. The small degree of magnification is particularly appropriate for children 3 to 7 years old. Instead of shrieking at, or stepping on live spiders, for example, children can learn to say, "Let's tell the teacher to bring the microscope here."

At first the youngest children may believe that the specimen can crawl out. It takes a while for them to approach with confidence and lower their eye to the lens. To better understand how the microscope works, they need to examine non-live specimens with a hand-held magnifying glass.



TOPIC: Finger print

OBJECTIVE: to observe and label your own finger print, to use a magnifying glass, to compare different finger prints, to develop an awareness of the uniqueness of finger prints and when our society fingerprints people

MATERIALS: black ink pad, white paper, magnifying glass, sponge, place to wash hands with soap

PRESENTATION: teacher presents and leaves on shelf for children to choose

TO DO: Put paper on table beside tray. Roll up your sleeves, and explain that in a few minutes you'll have to wash your hands. Open ink pad, place thumb on pad lightly, and print onto white paper. Hand paper with the thumb print to nearest child to observe and pass around while you wash your hands. Children who write can label the paper, "Pat's thumb print." Discuss the uniqueness of finger prints and when our society fingerprints people (at birth, in the army, in jail, when cashing checks, etc.)

ADDITIONAL INFORMATION FOR TEACHERS

The heavier older-type ink pad works better than the newest foam pad type. With a large pad, it's possible for the children to print their entire hand. Some children brought in their hospital birth registrations showing their infant foot print beside their mother's finger print.

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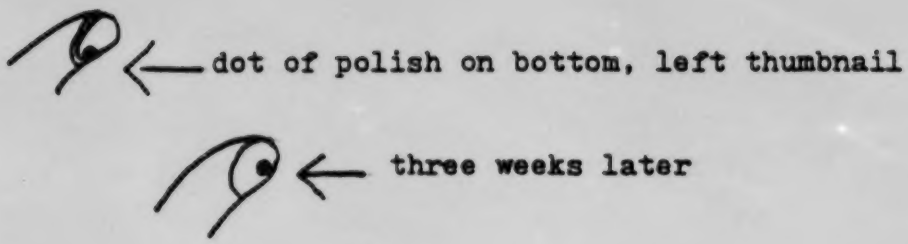

TOPIC: Fingernails

OBJECTIVE: to see that nails grow, to measure how much they grow in 3 weeks

PRESENTATION: The teacher puts a dot of polish on her own nail and asks who else would like to participate in this experiment. Some children will decide that they want to participate several days later.

MATERIALS: brown fingernail polish, tissues, tape that measures in millimeters

TO DO: Shake nail polish well. Put a dot of brown polish at bottom of left thumb nail. The polish will be less likely to wear off from this nail. Blow on it. Tell children you'll make the dot darker if it starts to wear off. In three weeks measure and discuss. Invite children to draw an outline of their thumb on paper and mark how much their nail grew (see illustration at top of page).

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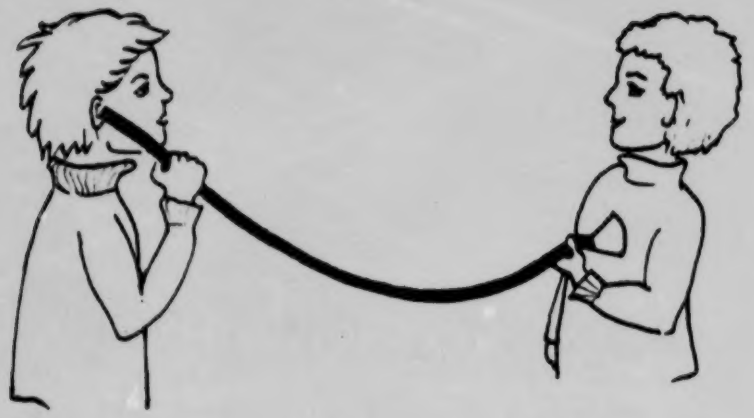

TOPIC: Homemade stethoscope

OBJECTIVE: to explore sounds by listening to their own or to another child's heart beat

MATERIALS: kitchen funnel and piece of rubber hose

PRESENTATION: The teacher or an older child makes the stethoscope while children watch. Afterwards it goes in a basket on the shelf as an activity for one or two children.

TO DO: Attach hose to funnel. Put funnel on heart and tube near ear. Listen. Count heart beats aloud. Jog in place and count beats aloud again. Older children might consider what the heart is doing and why it speeds up after jogging.

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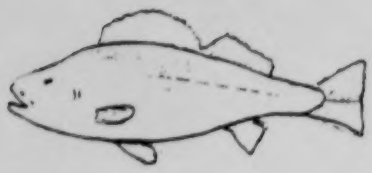
EXAMPLES OF THE FIVE CLASSES OF VERTEBRATES NUMBERED IN ORDER OF EVOLUTION



1. fish

2. amphibian

3. reptile

4. bird

5. mammal

VERTEBRATES IN THE CLASSROOM

Lower school science usually concentrates on the vertebrate animals. Try to have (at least as visitors) as many of the five classes as possible. Read appropriate stories about each animal. Provide appropriate pictures in sorting and matching exercises.

CLASSIFICATION EXERCISES

Before concentrating on paper-picture classification activities, it's important to first provide young children experience with the live animal. One interesting and different vertebrate classification activity can be ordered from In-print for Children. In addition to classification cards, In-print also sells vertebrate skeleton cards. These consist of 5 animal silhouette cards and 5 transparent overlays showing the animal's skeleton. To order see "Science Suppliers" section.

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FIVE CLASSES OF VERTEBRATES

	fish	amphibian	reptile	bird	mammal
habitat	water	water(when young) land	land water	air land water	land water air
skin	scales	soft moist skin	plates or scales	feathers	hair
respiration	gills	gills (when young) lungs or skin	lungs	lungs	lungs
reproduction	eggs without shells	jelly covered eggs	eggs with leathery covered shells	eggs in nest	young born alive
care of young	no care	no care	no care	brood and feed young	suckle and care for young
movement	swim	swim walk jump	swim walk slither	fly walk	walk swim fly jump
examples	shark tuna goldfish sea horse	frog toad newt salamander	crocodile snake lizard turtle	robin pelican duck pigeon cock	whale bat human leopard rat mole

GENERAL CHARACTERISTICS OF VERTEBRATE ANIMALS (any animal with a backbone or spinal column): comparatively large size, high degree of specialization of parts, bilateral symmetry, usually 2 pairs of appendages, internal skeleton of bone and or cartilage, spinal cord, brain enclosed in a cranium, closed circulatory system, heart divided into 2,3, or 4 chambers, wide distribution on earth

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Leopard frogs live in the Northeast section of the U.S.

TOPIC: Frog, crickets, and tadpoles

OBJECTIVE: to observe and prepare environment for an amphibian, to compare and contrast mammals and amphibians, to observe life cycle of a frog from egg to tadpole to frog, to observe and prepare an environment for crickets (which the frog eventually eats), to enjoy and listen to crickets chirp, to see how crickets produce their chirp, to witness nature's predator-prey relationship, to understand that some animals can be temporary pets that are then returned to their natural habitat.

MATERIALS: frog's environment 1 leopard frog (or frog that can survive in your area), 1 one-gallon aquarium with screen top, gravel, rock or wood chip, water plant

cricket's environment 8 crickets each week (purchased from the pet store), glass jar with holes punched in top, grass and weeds, oatmeal, small slice of apple

tadpole's environment tadpoles (from Carolina Biological Supply--see section on "Science Suppliers"), tadpole food (from Carolina Biological Supply), 1 gallon aquarium, rock or wood-chip, water plant

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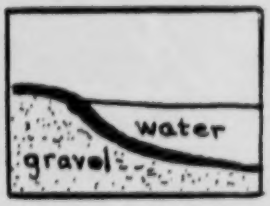
TO DO:

(1) frog

Purchase frog from local pet shop and set up the frog's environment. Discuss with children how the environment meets the animal's needs. Make sure that at least 1/3 of the aquarium is not under water. One way to do this is to put gravel in this formation.



This aquarium is easy to clean. Twice weekly scoop up frog in large glass and put lid on while rinsing the gravel and cleaning aquarium. Feed frog 1 cricket a day. On Friday pour remaining crickets into the above-water side of the aquarium. The frog will not eat dead crickets.

(2) crickets

Ask pet store owner to put 8 crickets in your tall glass jar. Inside have some grass or weeds, a small paper egg-carton cup for scooping out crickets. Provide crickets with a diet of oatmeal and a small slice of apple (for liquid).

Enjoy the crickets. In a dark or shadowed place they chirp more than in bright light. Cricket listening makes a nice silence game. Read George Selden's A Cricket in Times Square. Dramatize how crickets rub their wings together to make the chirping sound. Ask who has noticed their wings moving in this way. Make a "Parts of a Cricket" booklet. (See sections on "Parts of Animals" and "Materials Packet--sheets to reproduce for classroom activities.")

(3) tadpoles

Follow Carolina Biological Supply's information on how to raise tadpoles. They should be ordered in December with instructions to deliver in February. Read books on tadpoles. Provide cards with various stages of the life cycle. Release frog and tadpoles at end of school.

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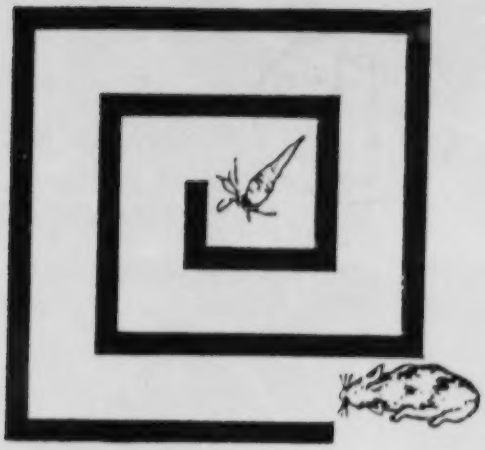

TOPIC: Class pet--hamster. Teddy Bear male hamsters are especially recommended because they're usually friendly and easy to handle.

OBJECTIVE: to enjoy, learn about, respect, and care for the class pet; new words-- environment , mammal, vegetarian

PRESENTATION: group projects and individual activities

TO DO:

(1) Introduction to the pet

From the first, introduce the pet formally and make very clear what its needs are. Discuss differences between pets and wild animals; "pets depend on us for their food, water, exercise, and homes." Make a job chart for clean-up and feeding. One large group presentation might be to show the bare cage. Then pour in chips and build up the pet's environment, discussing how each thing you add fills a need of the pet. Read a book about the pet and leave on nearby shelf.

(2) Food collage

Make a collage with pet's food. Older children can label the grains and pieces.

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Liberty or
"travel" ball

(3) Travel ball

At the pet store buy a "travel" or "liberty" ball. It's a clear plastic ball with lid and air vents. Inside a gerbil, hamster, or baby guinea pig can travel unharmed around the classroom. A firm ground rule must be that no one can roll the ball, and no one except the teacher can pick it up.

(4) Body map of pet

Before making body maps of the children, it's interesting to make a body map of the hamster (if you're on good relations, that is). Put the hamster in the middle of a sheet of paper. Tell the children that if (s)he squirms too much or seems too fearful, you'll try again another time. Quickly trace around the animal with a felt tip marker. Put the hamster back in the cage. Sketch in eyes, ears, and whiskers. Label and hang map near the cage. This activity has always been a lot of fun for the children and has never seemed to bother the hamster. On one memorable occasion a guinea pig actually picked up the marker and proceeded to make marks on the map. The children were sure he was trying to "color in his body map."

(5) Hamster in the maze

Build a maze with rods or blocks. Put a scraped carrot in the middle of the maze and put a hamster at the entrance. Observe and discuss what happens.

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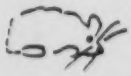
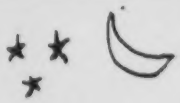
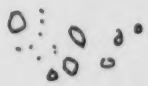
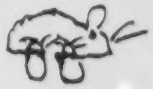
(6) Booklet of pictures and labels

Children color, label and staple pages together for a class pet booklet. See "Parts of animals" section for picture of a Teddy Bear hamster.

hamster	 *Sneakers	 nocturnal	 nuts & seeds	 mammal

booklet pages

(7) Classification as a mammal

See "Vertebrate animals -- classification activities"

*or whatever your pet's name is

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PARTS OF ANIMALS BOOKLETS

Make isolation booklets for parts of each animal. Label and color the entire animal on page 1. On successive pages, label and color one part per page. For more detailed information on how to make an isolation booklet, see "Parts of Plants Booklets" following the section "Adopt-a-Tree." Each of these animals has many parts and the booklets could be ten or more pages if eyes, mouth, toes, neck, etc. are labeled. Older children may enjoy this. For younger children it's simpler to limit the format consistently to 5 pages (if possible). Provide sample pages for children to copy.

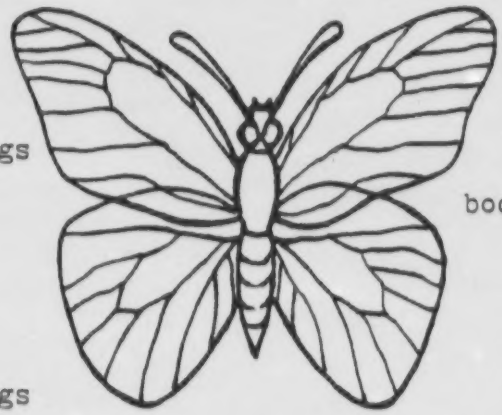
Pages to reproduce parts of a butterfly, feather, or cricket are in the "Materials Packet" section at end of this manual. All other booklet pages can be ordered from:

Montessori Services
C/O Jane Campbell
Box 249 RD 1
Glen Moore, Pa. 19343

and

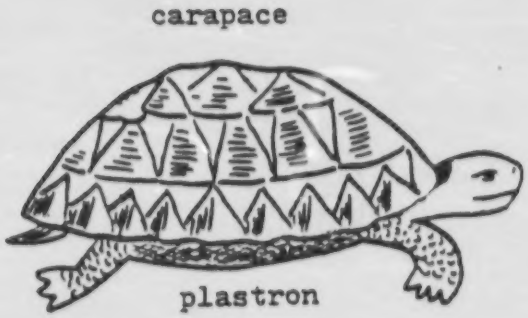
Designed for Children
Box 271
Kent, Ohio 44240

Make a 5-page booklet for parts of a butterfly



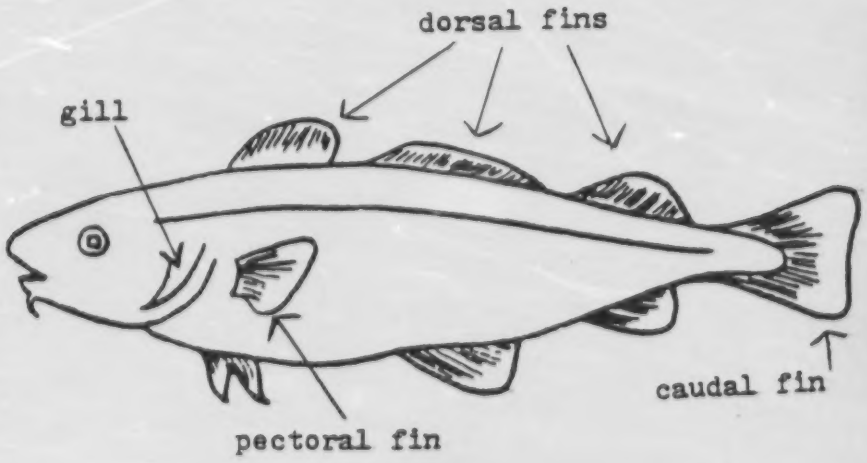
butterfly

A W. Rolfe Mount butterfly in a lucite hemisphere can be ordered for $9.00 from Carolina Biological Supply.(See section on "Science Suppliers.") After the butterfly arrives, make isolation pages to match the butterfly. Children can color the paper butterfly to match colors in the W. Rolfe Mount.



Make a 5-page booklet for parts of a turtle

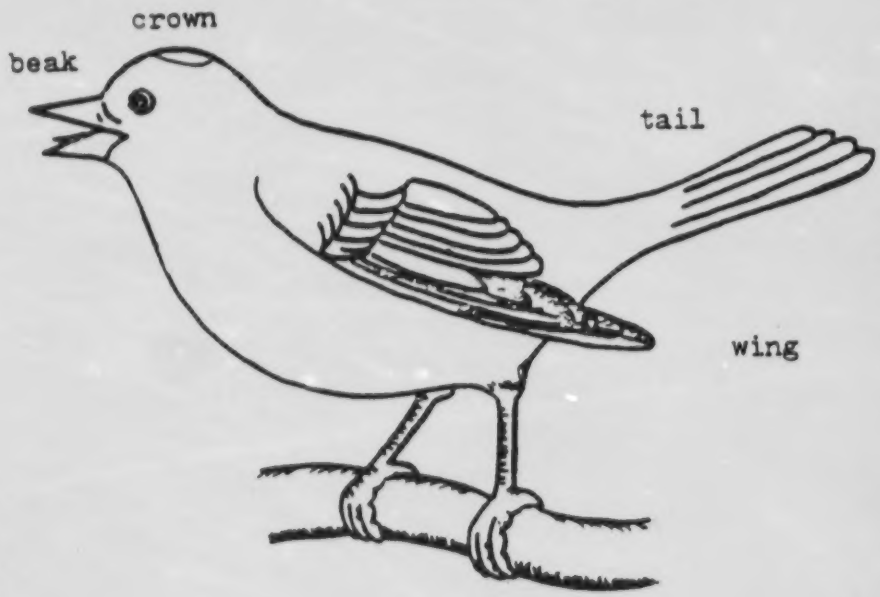
turtle



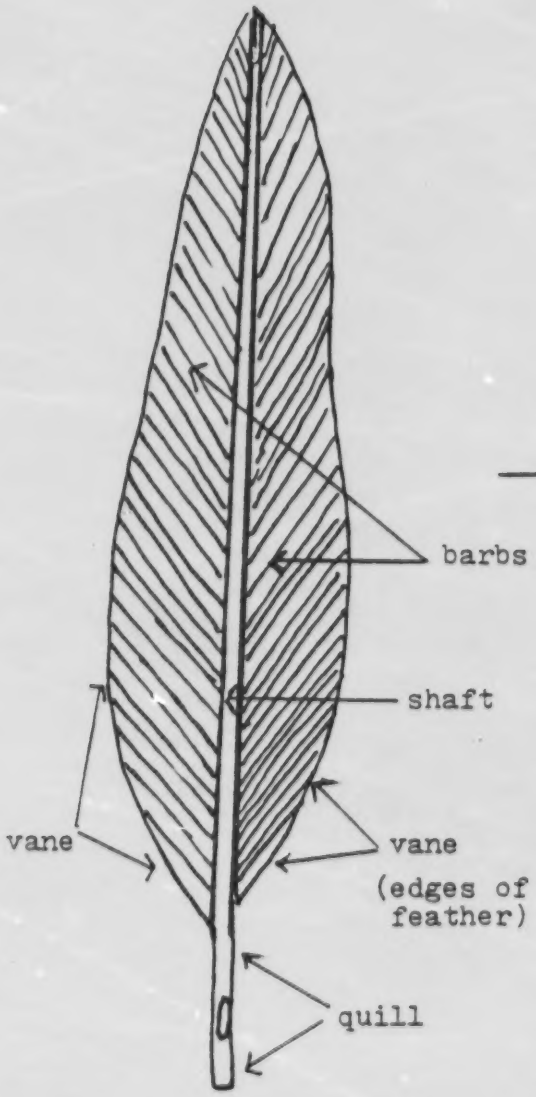
Make a 5-page booklet for parts of a fish

fish

Make a 5-page booklet for parts of a bird

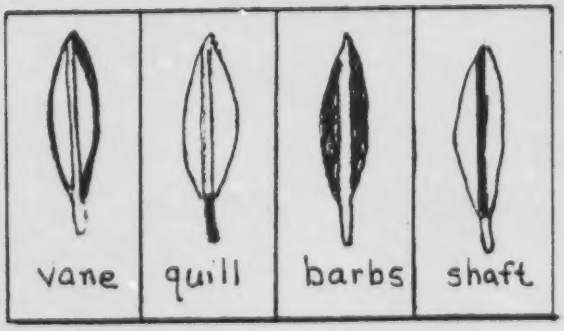


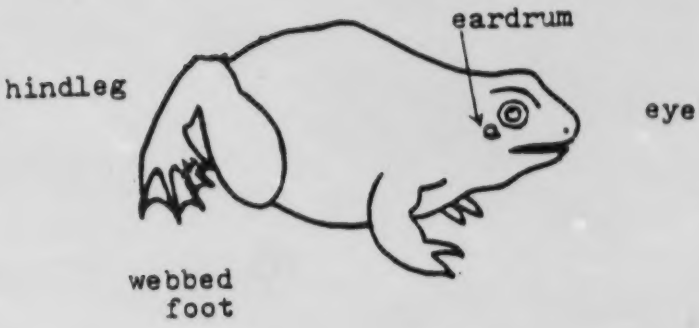
bird



feather

Make a 5-page booklet for parts of a feather

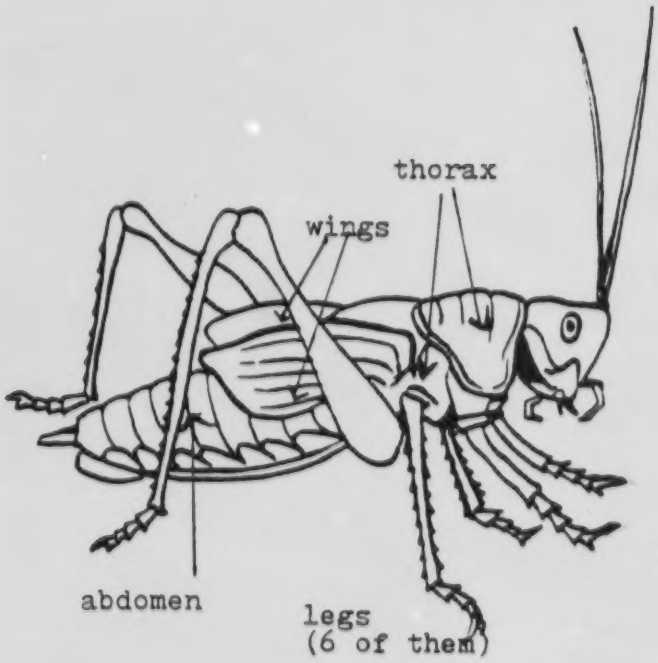




Make a 5-page
booklet for
parts of a frog

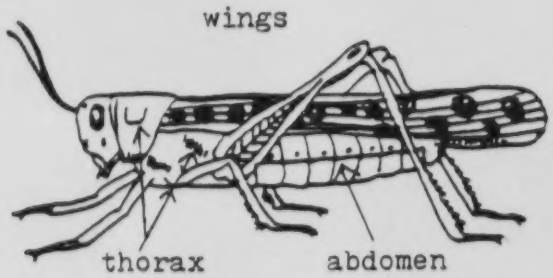
frog

Make a 5-page
booklet for
parts of a cricket



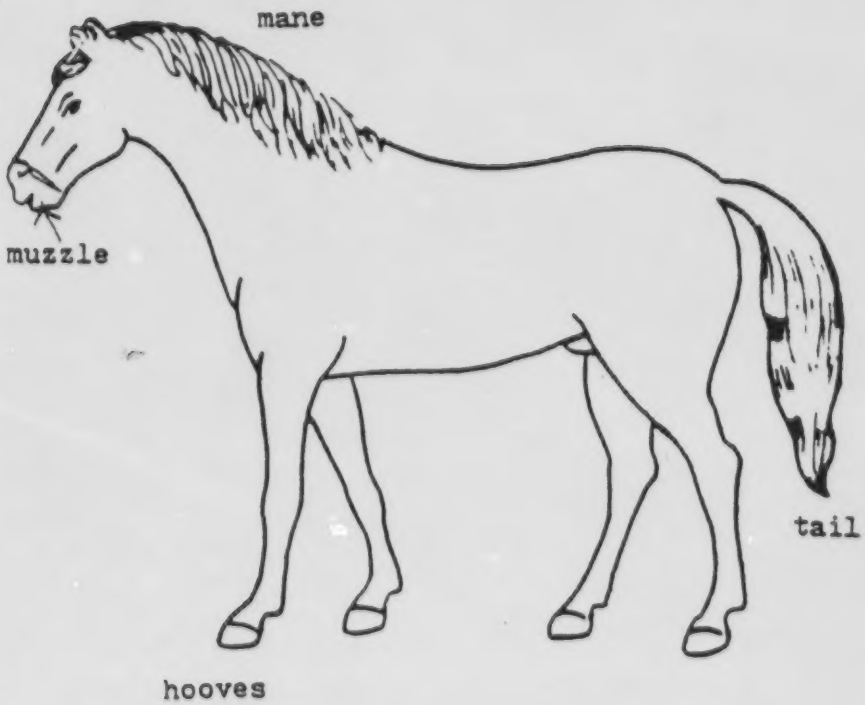
cricket

Make a 5-page
booklet for
parts of a grasshopper



grasshopper

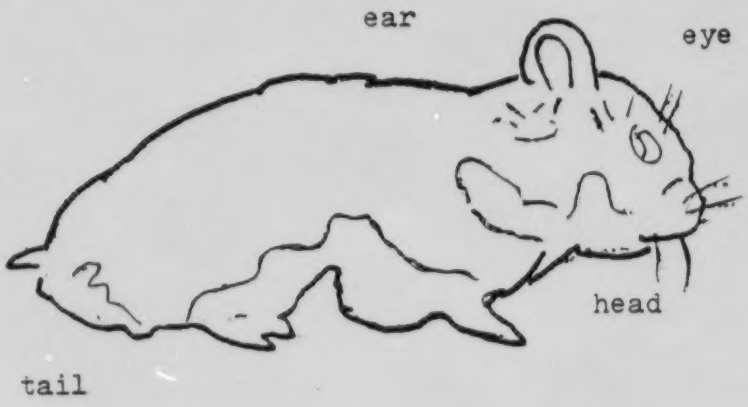
Make a 5-page booklet for parts of a horse



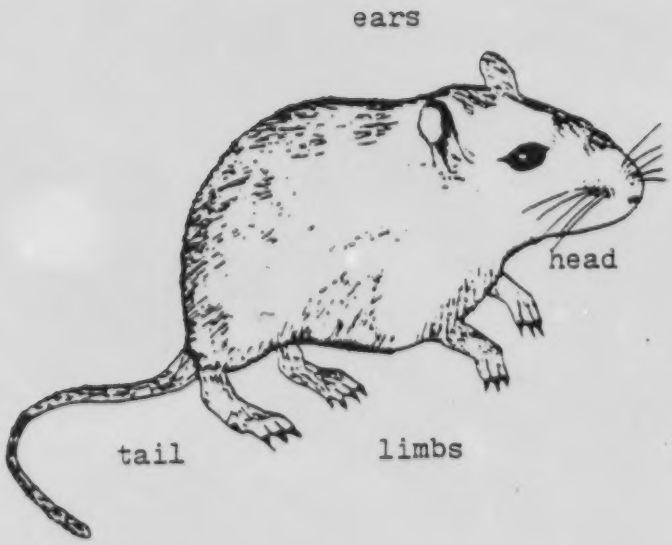
horse

Make a 5-page booklet of parts of a Teddy Bear hamster

See "Class Pet--Hamster" item 6 to use this page in another booklet.



Teddy Bear hamster



Make a 5-page booklet of parts of a gerbil

gerbil

TOPIC: Litter walk

OBJECTIVE: to develop an awareness of the environment, to understand what litter is and where it comes from, to observe and collect the kinds of litter in the neighborhood, to count and classify types of litter; new word - graph

MATERIALS: plastic bags with handles for each child, note pad, pencil, emergency supply of wet paper towels in a plastic bag in case someone gets hands messy.

PRESENTATION: Discussion and small group walk. Later the litter is classified and left for other classmates to see.

TO DO:

(1) Walk in neighborhood

Discuss beforehand what litter is. Start out with a general definition like, "Litter is garbage that isn't in the right place." Tell stories, invite their remarks, and try to emphasize that a drink bottle on the sidewalk is litter. A drink bottle in the trash can is not litter. Explain ground rules about collecting the litter they see. Broken glass and messy garbage does not go in their bag. On a note pad, the teacher writes or draws a picture of the item-not-to-be-picked-up.

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and puts the paper in their bag. Go slow at first and ask them to consult with you about whether an item is litter. If someone's bag is less full have others contribute items to that person's bag.

(2) Sort and classify litter

After the walk is over, examine litter and invite children to put different types of litter in garbage cans. Children or teacher can suggest ways of classifying the litter. One approach might be to fill three different garbage pails with bottles and cans, paper, and all other litter.

Of which type garbage did we find the most? Will we decide by counting or by the amount of space taken up? Leave cans for parents and classmates to see. Let children tell classmates what they did and describe where they found the most litter.

(3) Classification cards

Take photographs and collect pictures of objects as both litter and non-litter.

non-litter	litter
a clorox bottle on the washing machine	a clorox bottle in a lake
tissues in a pocket	tissues blowing in the wind
banana on a table	banana peel on sidewalk
boxes in store	boxes in street
tire on a car	car tire in empty lot
doll at home	doll in gutter

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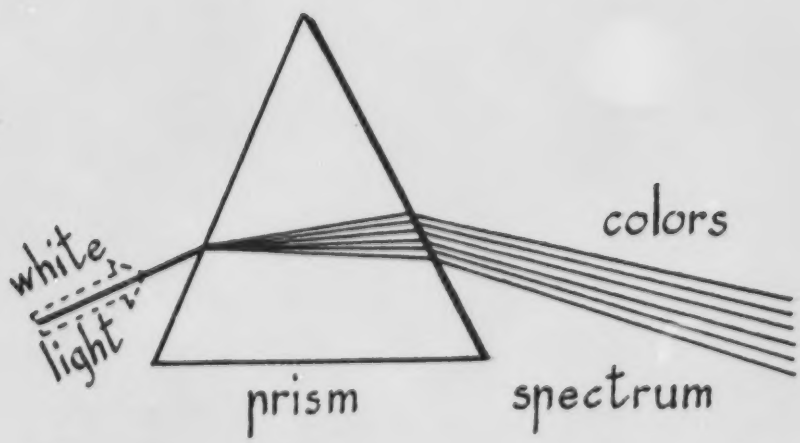
Physical Science



1. drop

2. float

3. spin

4. glide

TOPIC: Air and falling objects

OBJECTIVE: to observe and describe different ways objects fall or fly through the air, to compare and contrast the air's effect on different shapes, to make and enjoy an airplane, helicopter, and parachute.

PRESENTATION: The teacher presents to group and leaves objects and materials on shelf for children to use or to make their own.

TO DO:

(1) Crumpled and flat paper

Drop crumpled wad of paper and flat sheet of paper. Describe and discuss ways they fall. Measure falling times with stop watch or second hand of a watch.

(2) Make a parachute

Demonstrate in class how to make it and how to use it. Invite them to use it outdoors or in the gym. Invite them to bring handkerchiefs from home and make their own. Tie a piece of string about 25 cm (10 in.) long to 4 corners. Attach bottom of the strings to small object such as a spool, toy

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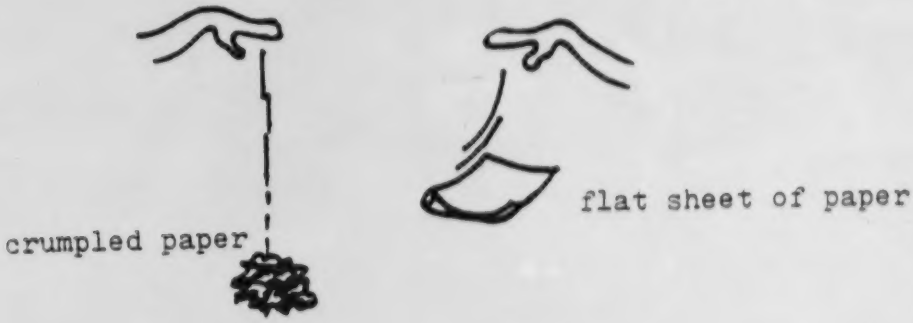

Measure the time it takes for each to fall to the floor.

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figure, or napkin ring. A human-shaped figure with arms causes the strings to tangle more. Put object in palm of your hand with napkin loosely folded on top. Cup hand and throw it up toward the ceiling. Invite children to vary weight of the parachute material, length of strings, weight of object, and to observe the results of these variations.

(3) Make a helicopter

Cut index card like this.

Fold card in a circle and tape. Then spread paper tabs so card looke like this.

Hold as high as you can reach and watch it spin like a helicopter when dropped.

Additional information for teachers

To set this up as an independent activity make a plastic stencil shaped like the cut index card above. Children place this over an index card and trace places they're supposed to cut. This helicopter can be made when studying maple tree seeds (See "Adopt-A-Tree" section). As they fall, maple tree seeds spin like a helicopter.

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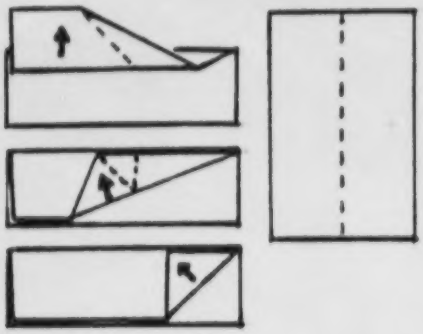

(4) Make an airplane

(a) Get a piece of paper 10 in. by 6 in.

(b) Fold it the long way down the middle.

(c) At one end turn each corner down.

(d) Fold again on each side.

(e) Fold back parallel to center fold and pinch together.

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liquid

solid

gas

TOPIC: Liquid, solid (gas is optional)

OBJECTIVE: to explore the relationship of liquids to their containers; to observe, classify, and compare water in various states; new words—liquid, solid, gas

(1) Exploring liquids (first activities)
Provide a large water table or water play area. If possible provide long plastic tubes which the children can fill and cork themselves; watching the bubbles go up and down is especially interesting. Also, on a tray set up a water pitcher, sponge, and containers of various sizes which children can fill with colored water.

(2) Watching ice cubes melt
Put an ice cube in a pan on the radiator. Invite the children to keep observing and describing what they see. "Now our ice cube is all water. It melted." Put another ice cube near the melted one. Dramatize the fact that you can pick up the cube but have to wipe up the water. Invite them to pick up the cube. Have volunteers wipe up the water while others watch. (Another day, for older children, leave melted water in pan on radiator and let them watch what happens. Teach new word, evaporate.)

(3) Liquid and ice; comparing and naming
MATERIALS: two pretty jars with tops (one should have a narrow neck), drops of two different food colors, one ice cube, small plate, water, deep basket, tea kettle (optional)

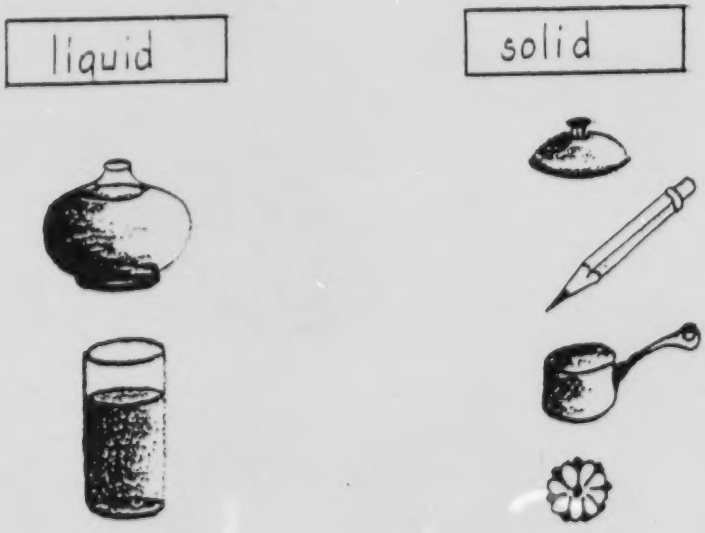
PRESENTATION: The teacher presents and leaves on a display table the first day. Afterwards, this may be adapted for

individual work choice and booklet making.

TO DO: Show children that no matter where you place the ice cube it is still shaped like a cube. Show them the two bottles of colored water. Pour water from one bottle into a cylinder; say its shape. Pour water into a bowl. Say its shape, etc., etc. "This is a liquid. It does not have its own shape." Make a label and place near bottles. "This is a solid. It has its own shape." Make a label ("solid") and place near the ice cube. Invite the children to watch the ice cube and to tip and shake the closed bottles of water. Later, after the ice cube melts, invite children to discuss what happened to it. "Water can be a solid or a liquid." (Optional activity at a later time: boil water and show that water can also be a gas.)

(4) Classification

Invite children to bring you some solids that won't melt. Put these in a basket with the bottles of colored liquid and two picture-word labels (see below). Children may choose this from the shelf and classify liquids and solids. Arrange bottles so they don't clank together.



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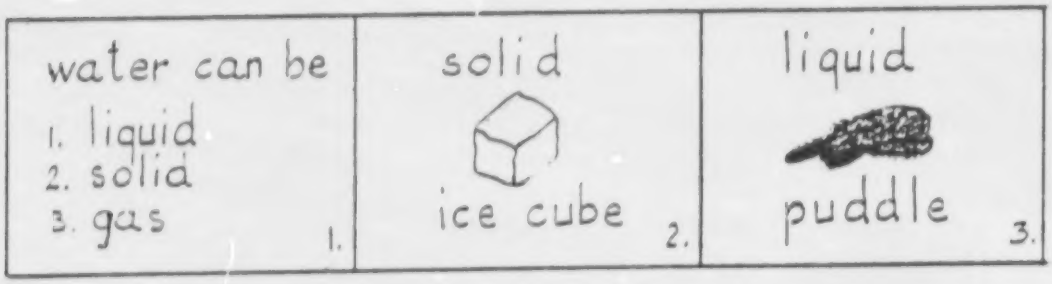
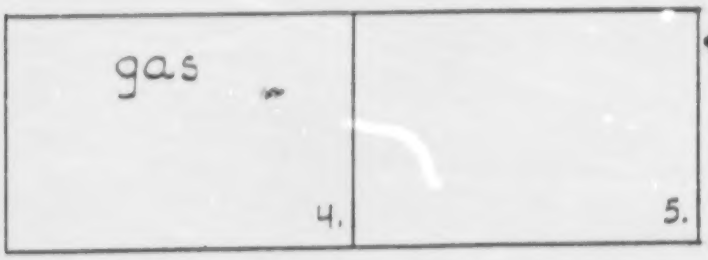
5. Liquid-Solid Game

On circle ask for volunteers to"bring me a liquid" or "bring me a solid." Once a few samples are gathered in the middle of the circle, play "I Spy" and have the children guess whether the thing you're describing is a liquid or a solid (which liquid or solid). To conclude have materials in the circle returned to their correct place: "Johnny please choose one solid and put it away," etc. Older children can be "teacher" for this game.

(6) Booklet making

Gather the children who are especially fascinated by this work, and invite them to make a booklet. If they can't write, provide ready-made booklets, and let them illustrate each page by drawing, for example, a cube or a puddle.





← Page 5 is for anything they want to draw, write, or dictate about solids, liquids, and gases.

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(7) Liquid Solid Dance

Invite the children to dance like a liquid, like a solid; demonstrate how to melt (slowly sink to the floor and progressively use looser body movements). A musical accompaniment might have soft up and down scales for a liquid and loud repetitions of single notes or chords for the solids.

(8) Making butter (changing a liquid to a solid)

A good follow-up activity is making butter. Pour heavy whipping cream into baby food jars till each jar is 1/3 full Cover. Let each child shake his/her own jar till the cream becomes butter. Provide crackers for a snack.

(9) Melting Snow (changing a solid to a liquid)

Place a coffee can of snow on the radiator or near heat. Invite children to watch and describe what they see. For an additional activity exploring pollution, strain the melted snow through a white cloth. Describe what you see in the white cloth. Discuss what else besides water snow is made of.

ADDITIONAL INFORMATION FOR TEACHERS:

Children especially enjoy these activities and will talk a long time about liquids and solids. Be prepared to admit that jello and applesauce are a bit puzzling, that paper bends and changes shapes. Yes, there are many "sort-of-solids" like play dough around. I usually acknowledge that it isn't always clear what's a solid or a liquid and ask, "What do you think?"

A four-year-olds definition: "You can put your hands inside liquids. You can't put your hands inside solids."

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TOPIC: Straws and paper snakes

OBJECTIVE: to observe what happens when the straw is lifted with a finger on top, what happens when the finger is lifted, to enjoy making a "paper snake"; new word--air pressure

MATERIALS: wide-mouthed container of colored water (water should be at least 3 inches deep), box of paper-covered clear plastic straws, sponge, tray or dish

PRESENTATION: The teacher presents and leaves on a special table or shelf for children to choose.

TO DO: Hold straw perpendicular to table. Push outer paper wrapping down into a tight wad at the bottom of the straw. Remove wad (keep tightly wadded) and set aside on a small dish. Put finger on top of straw, Lift from water. Call children's attention to colored water inside straw. "Now watch what happens when I lif my finger." Water should drip back into the container. Repeat several times very slowly. "Once you've learned how to do this, you can make a paper snake." Lift straw with finger on top,

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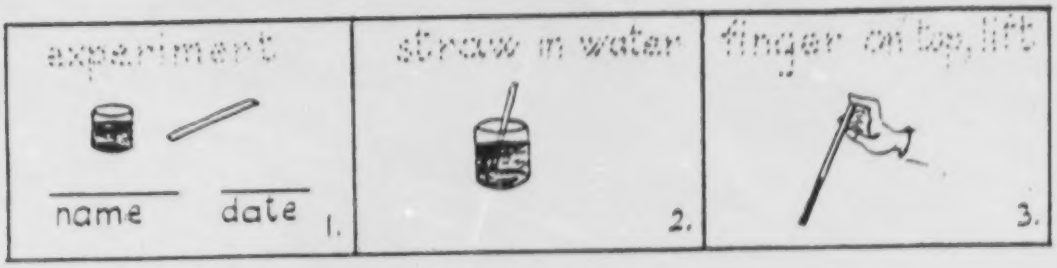
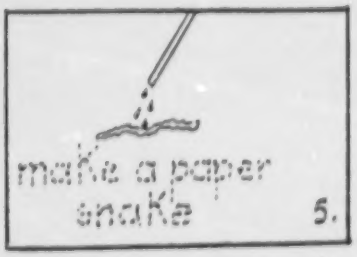


place over paper wad and let water fall. When wet, the paper uncurls and stretches out in snake fashion.

Gather those especially interested in this activity and give them pages 1-5 to color and perhaps trace. Words can be written in dotted fashion to facilitate tracing.



ADDITIONAL INFORMATION FOR THE TEACHER

Air presses down and up. When your finger was on top of the straw, the air pressure from above couldn't push out the water and the air pressure from below kept the water in the straw. When you moved your finger away, the air pressure from above and the weight of the water caused it to fall down into the glass.

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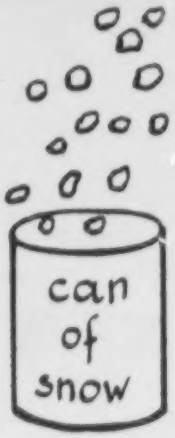

TOPIC: What is snow made of?

OBJECTIVE: to discover what snow is made of, to experience water as a liquid and a solid. If falling snow is especially dirty, this experiment can lead to a discussion of pollution.

MATERIALS: can, snow, white cloth

PRESENTATION: group project and discussion

TO DO: Place coffee can outside or scoop up snow. Place on radiator or near heat. Strain water (melted snow) through a white cloth. What else besides water is snow made of? Describe what you see in the white cloth.

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icicle

child doing the icicle chant

TOPIC: Icicles melting and freezing

OBJECTIVE: to discover what icicles are made of, to observe icicles melting, to experience water as a liquid and solid, to measure volume of water and length of icicle, to dramatize with their body how an icicle is formed

MATERIALS: largest icicle you or children can find

TO DO: Pass icicle around and let children hold it. Put in a large container and measure it. Time how long it takes to melt. Measure the volume of water. Invite children to bring in other icicles or large chunks of ice.

ICICLE CHANT Stand in position of child above. Hands go down toward the floor as the icicle grows longer. Hands go up toward the body as the icicle melts shorter.

Icicles freeze (stand in icicle position)
Drip, drip, drip
Longer, longer they grow
(repeat)
The sun comes out (stand up)

Icicles melt (stand in icicle position)
Drip, drip, drip
Shorter, shorter they go
(repeat)
Now they're all gone (stand up)

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2

TOPIC: Heat

OBJECTIVE: to observe and explore effects of heat, to compare and contrast temperatures, to measure temperatures, to conduct an experiment

PRESENTATION: These work well as small group projects led by a teacher or an older child. Number 3 and 4 can be put on a shelf for children to choose.

TO DO:

(1) nail in the sun

Lay a big nail in the sun and another the same size in the shade. One hour later pick them up. Is one nail warmer? Which one?

(2) black and white

Lay a black cloth and a white cloth in the sun. One hour later pick them up. Which is warmer?

(3) food dye in water

Pour 2 drops of dye in a glass of cold water and 2 drops in a glass of warm water. Don't stir--watch. Compare.

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(4) sugar in water

Dissolve 2 tablespoons of sugar in a glass of cold water and a glass of warm water. Compare.

(5) comparison of cotton and wool for holding heat

Pull cotton, wool, and no sock over three glasses of warm water. After 1 hour measure temperature of the water in each glass. Discuss why we wear wool coats in the winter and cotton shirts in the summer.

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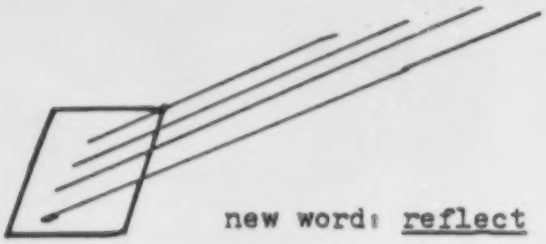

new word: reflect

MIRRORS

(1) Make colorful and interesting pattern cards to look at with a hand mirror. Invite children to explore and enjoy what happens when they hold a mirror in different positions around and on top of the cards.

(2) Show them how to place a small mat on the floor in a patch of sunlight and hold the mirror so that the sunlight reflects on the ceiling. "The sunlight bounces back from the mirror to the ceiling." New word: reflect. "Reflect means to give back or throw back. The mirror reflects light. It's throwing the light back on the ceiling." Ground rules should be that they may only reflect the light on the ceiling (not in people's eyes), and they must remain seated on the floor mat.

(3) The Magic Mirror Book by Marion Walter is an interesting book with its own mirror. It can go on the science shelf on a tray. To order, send $1.50 for item 10227 from:

Scholastic Book Services
906 Sylvan Avenue
Englewood Cliffs
New Jersey 06732

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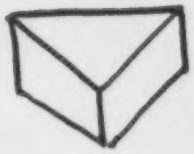
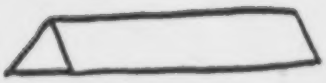
1 

2 

TOPIC: Homemade Kaleidoscopes

OBJECTIVE: to provide experiences showing the reflection of light, to see inside a kaleidoscope, to explore what 3 mirrors can do if arranged as a triangle, to enjoy moving color patterns

MATERIALS: 6 mirrors (about 3" x 10"), tape, tray, objects to look at

PRESENTATION: Teacher presents and leaves on the shelf for children to choose.

(1)wide kaleidoscope
Tape 3 mirrors together on narrow ends to form a triangle, 10 inches on each side (see illustration 1 above). Leave on a tray with a box of colored paper, 1 small ball, etc. Invite the children to put the objects inside the mirrors. Move the objects about and watch what happens. How many ping pong balls can you count? It's important that this kaleidoscope stay down on the tray and not be picked up. Children lean over to look into it.

(2) narrow kaleidoscope
Tape 3 mirrors together on wide sides to form a tunnel triangle, 3 inches on each side (see illustration 2 above) at the opening. Place on a tray with lace, a disk, buttons, etc. Invite the children to move the disk over the ends, wiggle their fingers in the end, look at the room, the lace,etc.

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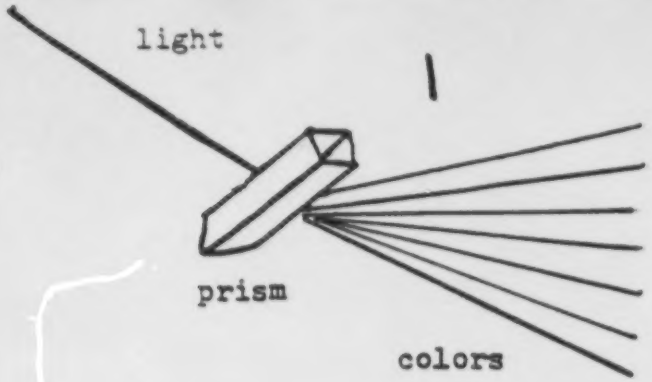

2

TOPIC: Rainbow

OBJECTIVE: to see what happens when light goes through a prism, to color and label (optional) a rainbow picture; new-word prism

MATERIALS: prism, mat for coloring, box of crayons or felt markers (red, orange, yellow, green, blue, purple), white paper

PRESENTATION: The teacher presents and leaves on a shelf for children to choose.

TO DO:

The teacher holds the prism to his/her own eyes or to child's eyes and rotates the prism till a rainbow is visible. Teacher says aloud the colors (s)he sees. "All these colors are in light. You can see them because the prism separates out the colors." On a white sheet of paper color and label a rainbow; leave as an example for children to color. Colors from outer to inner circle are red, orange, yellow, green, blue, violet or purple. See illustration 2 above. Children do not have to make colors in any particular order.

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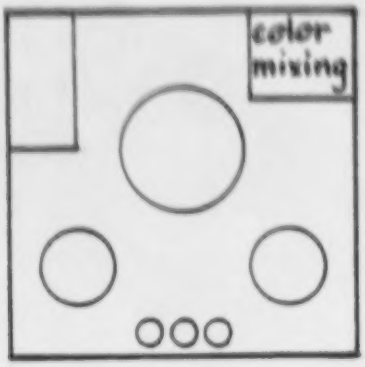

Place mat contacted with positions of pitchers and materials marked. Mat goes on top of small parsons table.

TOPIC: Color mixing

OBJECTIVE: to learn names of colors, to identify primary colors, to see what happens when various primary colors are mixed, to experience different ways of mixing colors: new word--primary colors

PRESENTATION: Teacher presents and leaves on shelf or special table for children to choose.

TO DO:

(1) Play dough

With play dough (homemade or bought) explore colors obtained by mixing: yellow and blue (green)
blue and red (purple)
red and yellow (orange)

(2) Color filters

Buy transparent color filters in the primary colors (red, blue, yellow). Cut sheets 12 X 20 cm (5 X 8 in.). Cover ends with tape. Put on shelf in a tray. When children look through a filter, the whole room appears that color. The effect is much more dramatic than the color paddles usually made for children. They can mix colors with the filters by

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placing 2 or more sheets together. Transparent color filters (stock no. 60373) in a package of 6 sheets can be ordered from Edmund Scientific.(See "Science Suppliers" section.) Photo supply places often have the same filters at less expense.

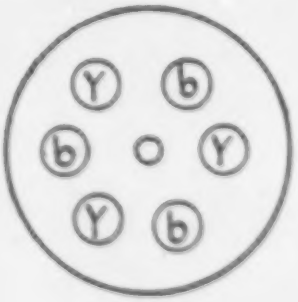
(3) Food colors and water

Materials needed: small plastic parsons table (16 X 16 in), 2 clear pitchers (16 oz.), 1 clear bowl with pouring spout, 1 sponge, 3 clear eye-dropper bottles filled with diluted primary food colors, 1 waterproof apron, 1 place mat contacted with positions of pitchers and materials marked. This mat should cover entire top of parsons table. (See illustration preceding page.)

Fill each pitcher with water (warm if possible) up to a mark at about 8 oz. Start with any 2 primary colors. Put one drop of each primary food color into each pitcher of water. Pour each pitcher into the mixing bowl. What is the new color? At first use only 1 drop of any 2 primary colors. Later (using instructions on food-color box) the number of drops of 2 or more colors can be varied. Dramatize proper clean-up and rinsing of bowls.

(4) Spinning top with flat surface.

On a paper disk (made from paper slightly heavier than typing paper) glue or color, for example, yellow and blue designs. Colors should alternate in a circle around the center.



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Colors can be mixed by spinning. Give children markers and paper disks to color. They enjoy seeing the "mixing" effects, as they spin their disk on a spinning top.

Put the paper disk over the top (punch or cut hole). Spin the top. Colors mix to form green in this instance. If the spinning color isn't pure green, it means the yellow or blue isn't a pure color. A purplish blue and yellow will spin to make brown (because of red mixed in the blue). Try to have a few disks that illustrate color-mixing principles.

The children may or may not be interested in achieving "real green." But they are definitely interested in coloring designs and then "seeing how they spin." This is a very popular activity and will be chosen from the shelf as an individual work choice for a long time.

The task of keeping a supply of paper disks available to color is much easier if you first cut a stencil in cardboard. Give a child who wants to help the stencil, a pencil, and white construction paper. (Heavy white computer paper is great for this, too.) Children seem to trace the disks well, but they have trouble cutting them. Invite them to spin an uncircular disk to see what happens. If this insight doesn't encourage them to be more precise in cutting, an adult will have to spend time cutting a supply of disks for this exercise. This time is well spent because of the children's interest.

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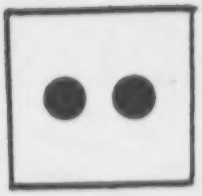

red circles

white paper

TOPIC: Staring at red circles (for older children)

OBJECTIVE: to experience green as the complement of red; new word: complement

MATERIALS: 2 pieces of plain white paper, 2 bright red circles (3/4 to 1 inch in diameter), tape, timer (optional)

PRESENTATION: The teacher demonstrates and leaves on the wall for children to use. Later they should discuss what they saw and why.

TO DO: On one sheet of paper glue 2 red dots 1 inch apart. Leave the other paper bare. Put both sheets 5 inches apart at eye level on the wall. Stand 2 feet away (mark spot on floor). Set timer to 2 minutes. Stare at red spots for 2 minutes. ..... then glance quickly at the blank sheet of paper. You will see green circles on the blank paper.

ADDITIONAL INFORMATION FOR THE TEACHER

Your eyes got tired of seeing red. So they saw all the other colors that make up light (leaving out red). All the other colors combined to make green. Green is the complement of red. Likewise, orange (red & yellow) is the complement of blue. Purple (red + blue) is the complement of yellow.

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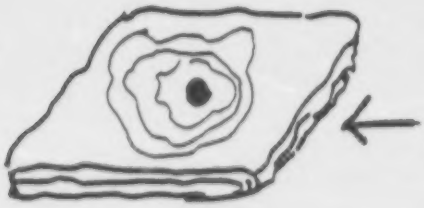

TOPIC: Chromatography or "color un-mixing"

OBJECTIVE: to experience "un-mixing" colors, to see that primary colors are not mixes of other colors

MATERIALS: roll of white paper towels, felt-tip marking pens of water soluble, non-permanent ink (all colors), eye dropper bottle full of water

PRESENTATION: This works well as a group project. It can also be left on a shelf for children to do by themselves.

TO DO: Fold each sheet of paper towel in half twice (4 layers, each about 5" X 6"). Take a felt tip marker and color a circle (no larger than 1/2 inch in diameter) in the center of the top layer of the towel. In upper corner make a dot of the same color or write the color of the marker used. After each child has folded and marked 4 towels with 4 different colors, show him/her how to drop 8 drops of water in center of colored circle. Watch as the colors flow out from the center. Orange and black are especially interesting. Name the colors that are in the circles surrounding the center. Note which color is farthest from or closest to the center. Emphasize that these colors were mixed together and now they're coming unmixed. See what happens with water on a primary color.

ADDITIONAL INFORMATION FOR THE TEACHER

Chromatography is "a process of separating gases, liquids, or solids in a mixture or solution by absorption."

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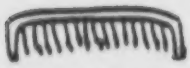
1 

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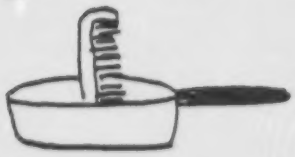
3 

Repeat 1,2, and 3
using exposed motor
of a wind-up music box

TOPIC: The sounding board

OBJECTIVE: to compare loud and soft sounds. to understand that the same sound can be louder or softer depending on what it's touching or next to

MATERIALS: comb, inner part of a wind-up music box (optional)

PRESENTATION: The teacher presents and leaves on a shelf for the children to choose.

TO DO: Rub fingernail over the teeth of a comb. Put one end of the comb on a wooden table and rub teeth in the same way. Repeat placing comb in a pot; on a plastic surface. Note and compare loudness of sounds in different places. Repeat experiment using inner part of a music box.

ADDITIONAL INFORMATION FOR TEACHERS

When the teeth are rubbed, they transmit their vibrations to the air. When the comb is against the table, its vibrations are transmitted to the table as well as the air. The vibrating wood in the table transmits vibrations to a larger volume of air and is thus heard as a louder sound. This is why pianos, guitars, and other instruments have sounding boards. Their sounds are amplified by the additional vibrations of the "boards."

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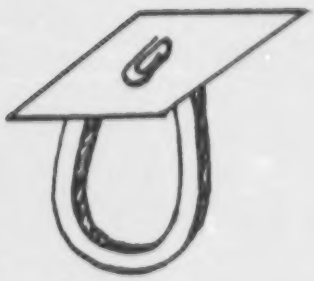
MAGNETS

How many paper clips
will your magnet hold?

Can a magnet
pull things
through paper....
through cardboard?



Can a magnet pull iron nails out of a
glass of water?

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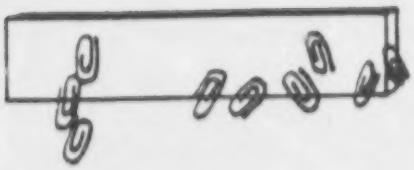
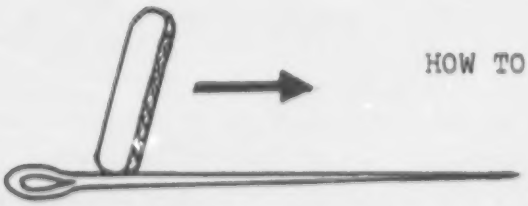


How many paper clips can you hang on different parts of a bar magnet?

The Real Magnet Book ($1.50) by Mae Freeman and Secret Magnets ($1.50) by Herman and Nina Schneider are well illustrated and full of interesting activities. Simple instructions tell, for example, how to make a magnet detector, how to go "magnet fishing," and how to have a magnet boat race. Small magnets come with each book.

Order from: Scholastic Book Services
906 Sylvan Ave.
Englewood Cliffs, N. J. 06732



HOW TO MAKE A MAGNET

Rub your magnet along a large needle. Always rub in the same direction 30 times. Now see if your needle will pick up a paper clip. Tie a thread around the middle of the needle and suspend it in mid-air. In what direction does the needle point?

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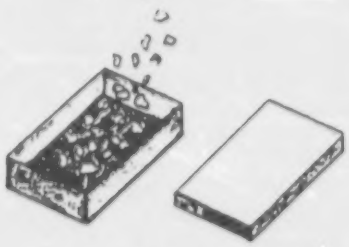
TOPIC: Static electricity— wait for cold, dry days

OBJECTIVE: to see the effect of static electricity, to understand that it's static electricity that gives the shock as they walk over rugs in winter, to understand that not all materials can be charged with static electricity

PRESENTATION: The teacher presents and leaves on the shelf for children to choose.

TO DO:

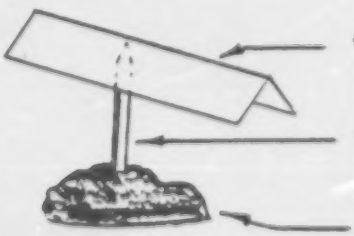
comb



pieces of non-cellulose sponge (or paper) in a box with a lid.

(1) jumping sponges

Take the lid off the box. Hold the comb over the box (nothing happens). Comb hair vigorously. Now when comb comes near box, sponge pieces jump out and stick to the comb.



folded paper

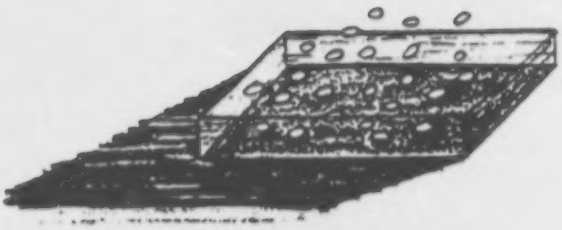
pointed popsicle stick

lump of clay

(2) turning paper

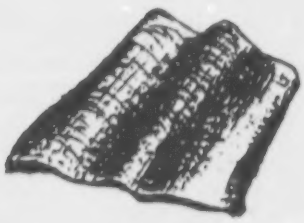
Rub a plastic pen on woolen cloth. Bring pen close to the paper strip. The strip follows the pen around. Try this with a pencil and other objects. Classify objects according to whether or not they can be charged with static electricity.

PLEASE NOTE These activities work best on cold dry days.



←puffed rice

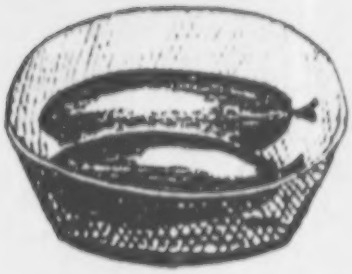
transparent, thin plastic box with a clear cover



woolen cloth

(3) Jumping cereal

Rub cloth vigorously over the top of the box. Soon the cereal will jump about. On an especially cold, clear day the cereal will follow your finger as you rub it over the box lid.



basket with 2 long balloons (dark colored)

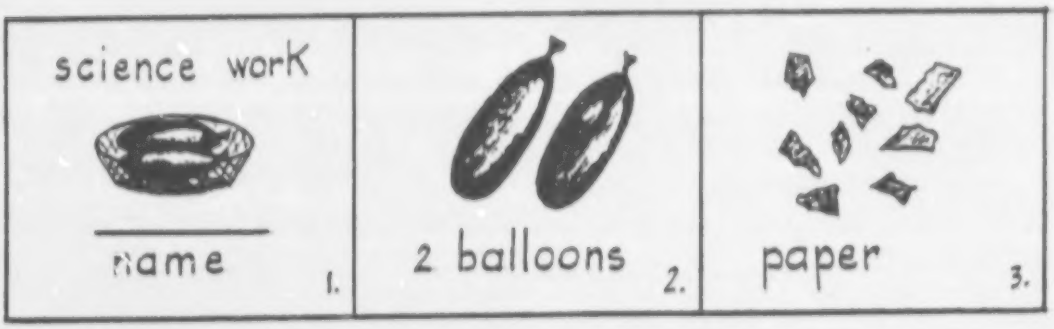
plate with small pieces of newsprint

(4) balloons and paper

Hold balloons over newsprint (nothing happens). Rub 2 balloons together and hold over newsprint.

(5) booklet of 6 pages

The booklet illustrated below accompanies activity 4 above. If they have sample pages to copy, most children who can write can illustrate this booklet themselves.



It rolls away and then....
it returns to you!??

1 oz. bank sinker
(fish weight) with
rubber band tied
in the middle

TOPIC: Pet Can

OBJECTIVE: to make a simple machine that stores and then releases energy, to compare and contrast behavior of regular can with pet can, to have a lot of fun and revel in the extra attention from older siblings and friends.

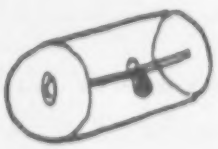
MATERIALS: 1 pound coffee can with plastic lid
1 rubber band (size 32 works best)
1 oz. bank sinker (fish weight)
2 paper clips (large or medium)
hammer
large nail
scotch tape

PRESENTATION: Present on circle or to small groups. Before rolling the pet can, first roll an identical coffee can that simply rolls away and stays away. Then present the pet can which rolls away and returns. Invite children to bring from home cans that you will later help them make into pet cans. Make cans with groups of 3 or 4 children at a time.

TO DO: Push the rubber band through the middle of hole in the bank sinker. This is the hardest part. (Younger children cannot do this: let older ones attempt this on their own first before helping them.) Tie a knot, making sure the sinker is in the

middle of the rubber band. With scissors cut <u>small</u> hole in plastic lid of the coffee can. Turn can upside down and hammer a nail hole in bottom of can. Turn nail from side to side to flatten jagged edges inside can.

Push the rubber band from inside the can through the hole in can's bottom. Hook rubber band on paper clip so that the clip will not pull back through the can. Push the other end of the rubber band through hole in the plastic lid and hook it onto another paper clip. Fit plastic lid on the can. Tape the paper clips in place. The bank sinker is now suspended on a taut rubber band in the middle of the can.



If the sinker touches sides of the can, the rubber band is not the correct size. It's too thin or too long. Size 32 rubber band works best.

Put can on floor or flat surface and count slowly to 5 before pushing the can forward. Counting allows the sinker to align itself properly if the can has been rolled about. The can rolls away and then returns to its original place. It will not usually return if it bumps or touches an obstacle.

It dances, too.

The pet can also dances. Hold can upright. Move can quickly with circular motions in the same direction. This allows the sinker to wind the rubber band in one direction. Place can on a table and watch it move from side to side.

Bonnie E. Nelson

ADDITIONAL INFORMATION FOR TEACHERS

The youngest children enjoy rolling the pet can, but they have trouble making it. Five-year-olds can do most of the work themselves. Even older children seem to need an extra pair of hands when trying to hook the rubber band into the second paper clip. Make up an extra bank sinker tied onto a rubber band for them to work with while you're helping others in the group. By turning the sinker in one direction and watching how it returns, they can begin to understand just how the pet can works.

To keep them from hurting their hands on the bottom edges, I always push the rubber band through and hold it till they have threaded it through the first paper clip. Always insist that because of the bottom inside edges, only an adult should fix the bottom end of the can.

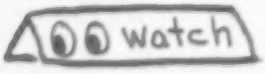
Add a note in your Parent Newsletter

What to do when your pet can dies:

Buy a new rubber band (size 32). Then your pet can can be good as new.

Parents please note: (1) Tie the sinker in the middle with a knot. (2) Inside bottom has sharp edges.

Other



TOPIC: Egg and vinegar experiment

OBJECTIVE: to understand what an experiment is; to see that it involves recording, hypotheses, timing, measuring, and--quite possibly--unknown or unexpected results; new words – experiment, hypothesis

MATERIALS: white vinegar, wide or medium mouth jar (16 oz. or larger) with a tight fitting lid, 1 raw egg, pen or marker, 6 large plain pages stapled as a booklet, tray, paper towels, calendar to mark, sign saying "watch"

PRESENTATION: The teacher presents to the whole group. Children watch for a week. The teacher represents and the children watch for two weeks.

Throughout the teacher's attitude should be, "I wonder what will happen if we do thus and such." To really convey what an experiment is the teacher must not see her/himself as an "abra-ca-dabra" magician or as a cook, who knows exactly what a dab of this and a cup of that will produce. All results must be welcomed. In the true scientific spirit no experiment is a failure.

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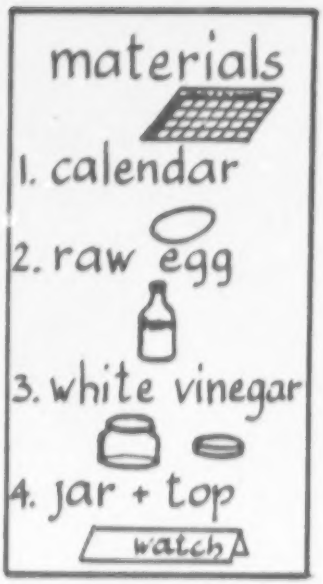
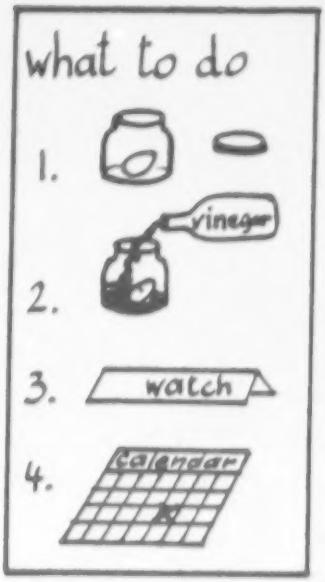
TO DO:

page 1

page 2



page 3



(a) Teacher announces, "We're going to do an experiment and make a booklet as we go along." (Write and illustrate page 1 above.)

(b) Explain and illustrate page 2 (above).

(c) Say, "We're going to put an egg in a jar and pour white vinegar on top." (Illustrate and label page 3.)

(d) "But first, before we do this experiment, let's think about what might happen. Let's hypothesize. What do you think will happen?" Record children's answers (page 4 of booklet). Define hypothesis. "We've just been making an hypothesis. That's when you think about and say what might happen next."

page 4

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page 5

What happened

day 1. _____

day 4. _____

day 7. _____

(e) Pour vinegar into the jar. Close lid tightly. Mark the date on a calendar and circle the date it will be in 7 days. Watch egg with the children and describe what you're seeing. (Bubbles form on the shell and the egg could float and be larger within a few hours.)

(f) Put egg jar on a shelf or display table with a folded "watch" sign. Explain, "This is watching work. We may not touch it until the date on our calendar."

(g) On page 5 of booklet write what happened on day 1 and day 4.

(h) On day 7 open the jar, pour the vinegar down a drain, and rinse scum off egg with cold water. Odor is not unpleasant.

(i) Invite the children to sit quietly. Bring the egg to each child who may touch it gently with 2 fingers. Note the yolk floating inside. Say, "I wonder what will happen if I drop this egg." In the middle of a table or floor space, hold egg 1 inch up and drop it. Continue raising the egg 1 inch higher and dropping it until it breaks. When the egg breaks the children love it. They think the teacher has made a very messy mistake.

(j) Clean up with paper towels (a sponge won't work), and record what happened on page 5 of the booklet.

(k) Say, "I wonder what would happen if we left an egg twice

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as long." Discuss the meaning of "experiment." "An experiment is a project you do to learn something new." Repeat the experiment leaving the egg for 14 days.

(1) Invite children who write to make their own booklet of the experiment.

ADDITIONAL INFORMATION FOR THE TEACHER

Children may well do this experiment at home and bring in their egg to share the results with the class. Sometimes these eggs from home are cooked, in red vinegar, or whatever. Be enthusiastic and say, "Well, I wonder what happens if we bounce a cooked egg from wine vinegar."

The egg in vinegar softens because the acid in the vinegar dissolves calcium from the shell. The egg may bounce like rubber but it's not a rubber egg. The egg usually bounces best if left 14 to 18 days. Repeat the experiment if the egg cracks and the yolk falls out into the vinegar. The children enjoy watching the yolk seep out; this egg, however, cannot bounce or be handled.

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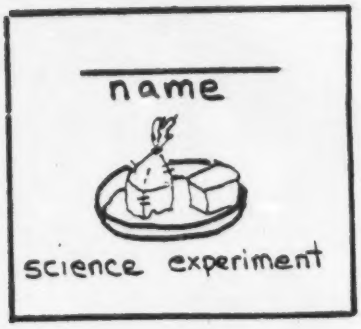

materials	to do	what happened?
2 ice cubes 1 cloth 1 rubber band 1 pan 2	1. Wrap one cube 2 Put both cubes in a pan in warm place. 3	_____ _____ _____ 4

TOPIC: Ice cubes--wrapped and unwrapped

OBJECTIVE: to do an experiment alone (or with one other child), to record results (older child), to see effects of insulating material

MATERIALS: See page 2 above.

PRESENTATION: The teacher gives one or two children the ready-made booklet, discusses it, explains where materials are, and invites them to do the experiment alone.

TO DO: Using the 4 page booklet illustrated above, the child does the experiment and shares the results later with classmates. (The unwrapped cube melts long before the wrapped one does.)

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heavy

light

TOPIC: Light and heavy

OBJECTIVE: to grade a series of objects from light to heavy in weight (mass), to measure weight (mass) of objects in the series

MATERIAL: assorted small and medium sized objects, a spring or balance type scale in grams or ounces (spring type is best here), paper and pencil, basket for objects

PRESENTATION: The teacher presents and leaves on the shelf for children to choose. This is also a good group project.

TO DO: Pick up each object and say, "I'm looking for the heaviest." Find, and place at one end of the mat. "Now I'm looking for the lightest." Place at other end of the mat. Fill in between with objects from lightest to heaviest. Older children, who understand the use of a balance or spring scale, can measure and record mass (in grams) or weight (in ounces). On a sheet of paper--as each object is weighed--record its weight and place paper beneath the object. When all objects have been weighed, check to see that the numbers on the papers descend or ascend in proper order.

ADDITIONAL INFORMATION FOR THE TEACHER

If this is to be a metric exercise, the expression is, for example, "The rock has a mass of 30 grams." (Not, "The rock weighs 30 grams.") "Is the mass of this block more or less than that block?" Children who cannot count by tens or do not use the 100's board have trouble with this exercise. This exercise stimulates some to return to these boards.

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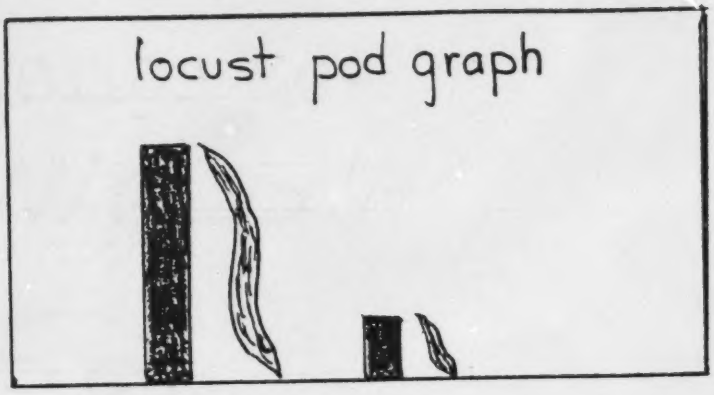

TOPIC: Locust Pod Graph

OBJECTIVE: to compare longest and shortest, to make a simple graph, to measure in centimeters; new word—graph

MATERIALS: 1 small cardboard poster, 2 honey locust pods (or something from nature to measure), tape, crayon, centimeter measuring tape, writing marker or pen

PRESENTATION: Find something natural in the environment with qualities of long (or tall) and short and invite children to bring them to class for observation and discussion. Pine cones, reeds, cat-tails, leaves, pods of all sorts will serve as long as they don't dry out and disintegrate too soon. Honey locust pods are especially interesting. Make a wall poster graph with the children. Put it in a place where they can measure it easily and compare the lengths of newly found pods with pods already on the graph.

TO TO: Find shortest pod and tape it on the poster. Find the longest pod and tape it on the poster. Let children argue, compare, measure, and decide which two pods go on the graph. To label longest and shortest pod is usually enough for younger children. With children interested in measuring, invite them to use centimeter tape and measure length of pods. They will have trouble since the pods curve. Several will get different

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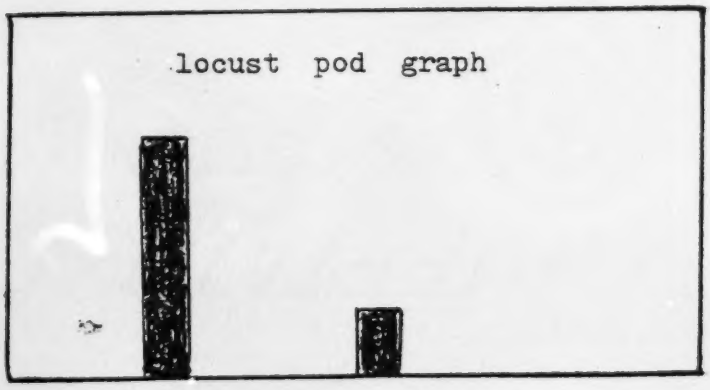
measurements. Let them have this problem first; then say, "Let's make a graph." Outline and let children color in a bar the length of each pod. "This is the length of our shortest pod." Invite them to measure the two bars on the graph. Do not write in measurements on the poster. Put the poster on the wall at a height they can reach and comfortably measure. Invite them to find an even longer or shorter pod. Change the poster graph (or add new bars and pods) as they find longer or shorter samples.

When pods disintegrate and fall off, leave poster on wall with only bars on the graph. Refer to it occasionally as "our graph." Ask older children, "Do you remember how many centimeters long our shortest locust pod was?" Even though the pod is gone, many will remember that in order to find the answer, they must measure the shortest bar on the graph. This is why you should not write in the centimeter measurements on the poster.



When pods disintegrate and fall off, leave poster on wall with only bars on the graph.

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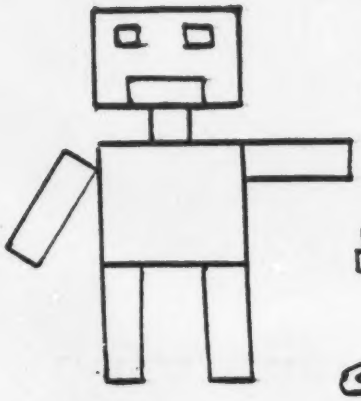

Metric Droid

one-centimeter cubes

centimeter measuring tape

TOPIC: Metric Droid

OBJECTIVE: to measure, to use the metric system as the usual standard of measurement; new word—centimeter

MATERIAL: Metric Droid sheet or booklet, 8 one-centimeter cubes (white cuisenaire cubes or smallest pink tower cube), measuring tape marked off in centimeters.

PRESENTATION: The teacher presents and leaves on a shelf for children to choose. Good group project.

TO DO:

(1) Measure the droid using centimeter cubes

Young children can use 1 droid on a full page. They measure by seeing how many one-centimeter cubes long parts of the droid are.

(2) Measure the droid using a centimeter tape

Once the child understands how to measure, give him/her a centimeter measuring tape. First line up the one-centimeter cubes on the tape to show that each division on the tape is the same distance as the side of a cube. Invite the child to measure the droid using only the tape measure.

(3) Booklet of parts to measure

Make a booklet for older children who can write numbers. Shade in the portion of the droid to be measured.

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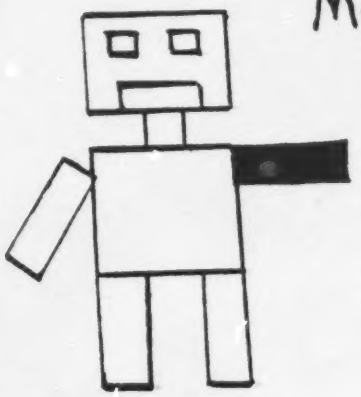
Metric Droid



Its arm is ___ centimeters long.

Sample booklet page with portion to be measured shaded in

Adapt the sample page shown above for a five page booklet measuring arm, leg, mouth, neck, and body. Because of shaded in portions children don't have to read to do the booklet independently.

ADDITIONAL INFORMATION FOR TEACHERS:

When teaching the children the metric system, use from the first the metric measure. Do not confuse them with conversion exercises. If they start considering how many centimeters equal an inch, they will understand neither inches nor centimeters.

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The standard paperclip has a mass (weight) of 1 gram, a width of 1 centimeter, and wire diameter of 1 millimeter.

THE MOST COMMONLY REQUIRED METRIC (SI) UNITS ARE:	
*(1) kilometer (km) for distance.	The George Washington bridge is approximately 1 km long.
(2) meter (m) for moderate lengths.	The height of an average door is approximately 2 m.
(3) centimeter (cm) for body dimensions and clothing.	A standard paper clip is 1 cm wide.
*(4) millimeter (mm) for very short lengths.	A dime is 1 mm thick.
(5) kilogram (kg) for mass (weight).	A quart of 7-Up (not including the bottle) has a mass of approximately 1 kg.
(6) gram (g) for mass (weight).	A nickel (5¢) has a mass of 5 g.
(7) liter (ℓ) for volume.	A quart of milk is approximately 1 ℓ.
(8) milliliter (ml) for small volumes.	A tablespoon holds 15 ml.
(9) Celsius (C) for temperature.	30°C is a warm summer day.

When teaching children the metric system, use from the first the metric unit. Do not confuse them with conversion exercises. If they start considering how many centimeters equal an inch, they will understand neither inches nor centimeters.

Measuring exercises for young children usually start with length. Choose one of the following pages. Tape it to your kitchen cabinet and live with it till thinking in those dimensions becomes easy. Every year (or six months) tackle another page and SI unit.

*not commonly used with young children

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CENTIMETER (cm)

smallest pink tower cube
(Montessori equipment)
1 cubic centimeter
1 cm (length of each side)

above line
1 cm

diameter of a penny
*2 cm

width of standard paper clip
*1 cm

shortest red rod
(Montessori equipment)
10 cm (or 1 decimeter)

*approximately

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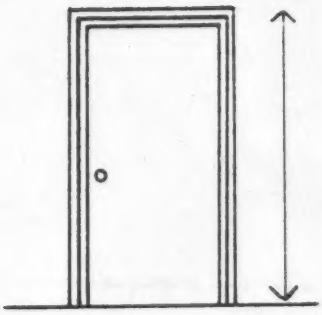
METER (m)



height of average door
*2 m

a long stride
*1 m

longest red rod
(Montessori equipment)
1 m

*approximately

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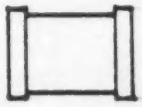
GRAM (g)

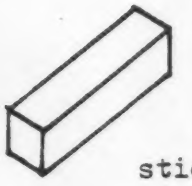


color tablet
(Montessori equipment)
*12 g

*5g

1 raisin
*1 g

*500 g



stick of butter
*100 g

EXPRESSIONS USING MASS (WEIGHT)

A stick of butter has a mass of 100 grams.
A nickel has a mass of 5 grams.
What is the mass of a raisin?

*approximately

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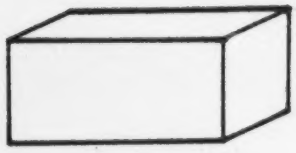
KILOGRAM (Kg)

2 cans of coffee
*1 kg



next to thickest brown stair
(Montessori equipment)
*1 kg

*1 kg

EXPRESSIONS USING MASS (WEIGHT)

What is your mass?
Her doctor recommended a mass loss of 10 kilograms.
Our beagle has a mass of 8 kilograms.

*approximately

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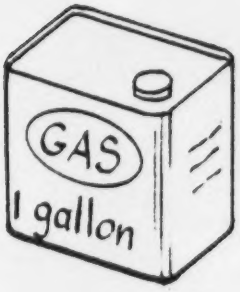
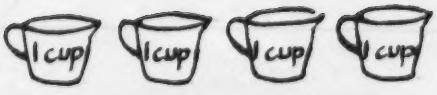
LITER (ℓ)

*1 ℓ



*4 ℓ

*1 ℓ



4 eight ounce cups of liquid
*1 ℓ

*approximately

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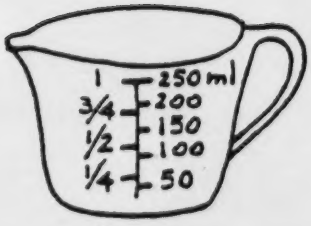
MILLILITER (ml)

1 tablespoon
15 ml

1 teaspoon
5 ml



metric measuring cup
250 ml

1 drop from an eye dropper
*1 ml

*approximately

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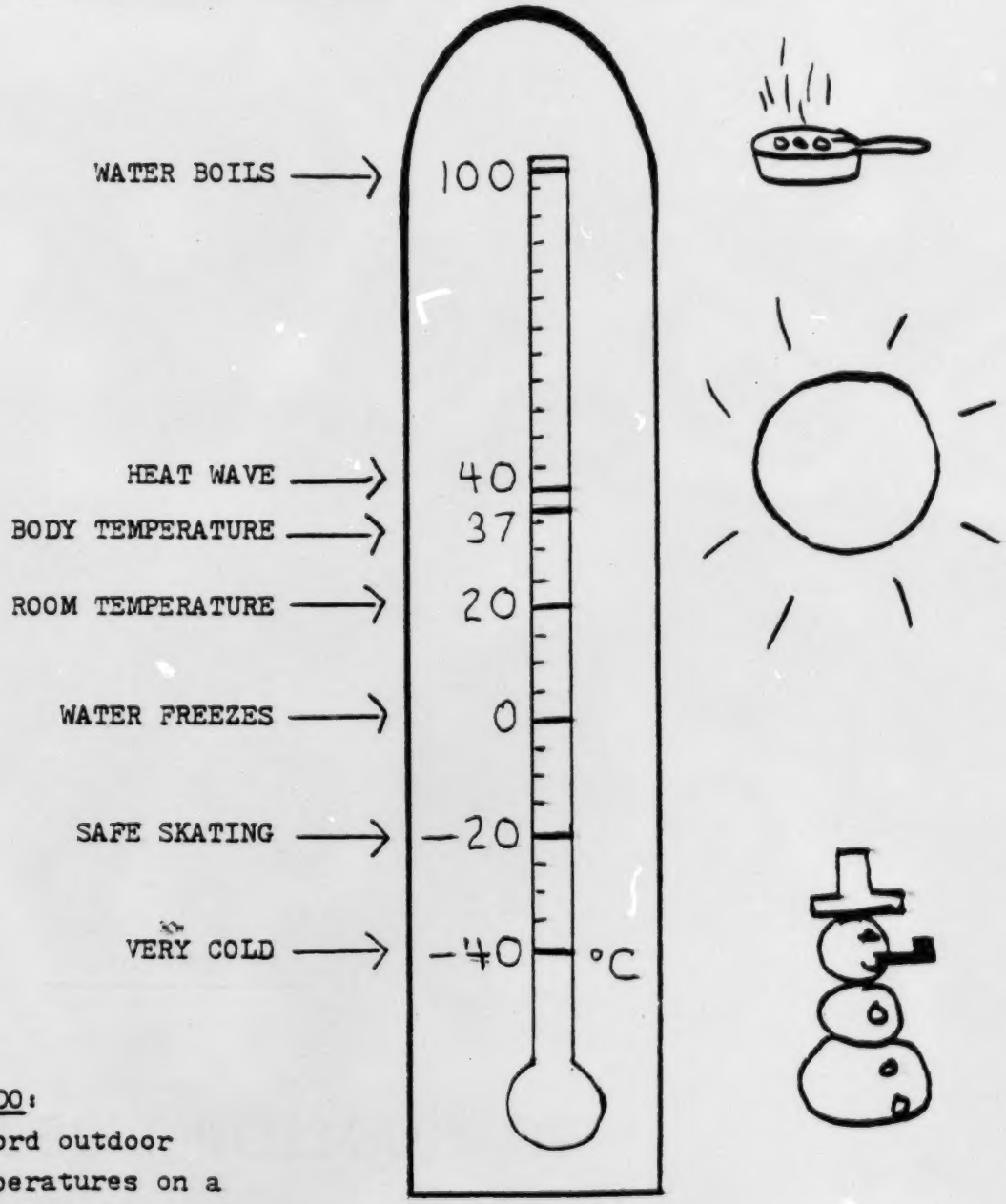
CELSIUS (C)



TO DO:
Record outdoor temperatures on a graph paper chart.
Children color in each day's temperature.

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*BOOKS

Cobb, Vicki. Experiments You Can Eat. New York: J. B. Lippincott, 1972. Especially good for 7-10 year olds. Can be adapted for younger children.

Darby, Gene. What Is a Tree. Chicago, Ill.: Benefic Press, 1962. Very good for pre-school age. Good explanation of color changes in trees.

Fox, Sally. Tasty Adventures in Science. New York: Stratford Press, 1963. Outlines many experiments. Good resource for teachers because of background explanations provided.

Hawkins, Frances Pockman. The Logic of Action: Young Children at Work. New York: Random House, 1969. Story of her experiences with hearing-impaired children. Interesting observations on how young children learn and how to use science in the pre-school classroom.

Hussey, Lois and Catherine Pessino. Collecting for the City Naturalist. New York: T. Y. Crowell, 1975. Excellent resource book for teachers. Well illustrated.

Lady Bird Books--See listings of many Lady Bird science books available from AMS.

Milgrom, Harry. Adventures with a Ball: First Science Experiments. New York: E. P. Dutton, 1965. Simple reading. Suggests activities for children to do on their own. See also Adventures with a Cardboard Tube, Adventures with a Straw, and Adventures with a String.

Nickelsburg, Janet. Nature Activities for Early Childhood. Reading, Ma: Addison-Wesley, 1976. A very good book to have. Can still be ordered from Addison-Wesley (Reading, MA 01867) for about $10.50.

Piltz, Albert, et. al. Discovering Science 1 and 2. Columbus, Ohio: Charles E. Merril, 1970. Two separate books. Good source book for teachers. Suggests experiments and activities appropriate for young children

Stein, Sara. Great Pets. New York: Workman, 1976. Good resource book for children and teachers. Well illustrated.

Wyler, Rose. A Golden Exploring Earth Book: Science. Racine Wisc.: Western Publishing, 1957.

_____ What Happens If: Science Experiments You Can Do by Yourself. New York: Walker, 1974. Simple reading. Suggests activities for children to do on their own.

*See also "Science Suppliers--Scholastic Book Services."

SCIENCE SUPPLIERS

Burpee Seed Company, 300 Park Ave., Warminster, Pa. 18991. Good to be on their mailing list. For growing carrots in a flower pot, order "Little Finger" carrots (#5087) after 1982 (crop failure that year).

Carolina Biological Supply, 2700 York Road, Burlington, N. C. 27215. Toll free phone is (800) 334-5551 Write for their glorious catalogue of live and preserved specimens. Also good equipment, games, and books. To order frog eggs, place order in December for delivery in January or February.

Childcraft Education Corp., 20 Kilmer Road, Edison, N. J. 08817. Toll free phones are (800) 631-5652 and in New Jersey (201) 572-6100. See science sections of their catalogue. The microscope by Semper ("Little Learner Experiment" series) is excellent for young children (order number N625).

Delta Education, Inc., Box M, Factory Street, Mashua, N. H. 03061. Toll free phone is (800) 258-1302. Inexpensive zoology and botany materials that can be ordered in small quantities. Good source of inexpensive balance scales and plastic aquaria. Write for Elementary Science Study catalogue.

Designed for Children, Box 271, Kent, Ohio 44240. Matching cards, parts of animals (pages and control cards), lots of well-priced and serviceable equipment such as trays, dropper bottles, pitchers, etc. Write for catalogue.

Edmund Scientific, 101 E. Gloucester Pike, Barrington, N. J. 08007. Toll free phone is (800) 257-6173. Equipment for physical science. Good source of magnets, prisms, rainbow glasses, color filters, and games for older children. Write for catalogue.

In-Print for Children, 2113 Kenmore Ave., Glenside, Pa. 19038. Zoology classification cards, skeleton and constellation transparent overlays with matching silhouette cards. Send $1.50 for description sheet and samples.

Montessori Creative Portfolio, P. O. Box 15132-L, Cincinnati, Ohio 45215. Matching cards, needs of man cards.

Montessori Services, C/O Jane Campbell, Box 249, RD 1, Glen Moore, Pa. 19343. Matching cards, pages for parts of animals, trays, containers.

Southwestern Montessori Training Center, P. O. Box 13466, N. T. Station, Denton, Texas 71203. Wide variety of materials, time lines, life cycle, description of animal phyla.

Teaching Resources, 50 Pond Park Rd., Hingham, Ma. 02043. Science sequence cards.

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MATERIALS PACKET--SHEETS TO REPRODUCE FOR CLASSROOM ACTIVITIES

Butterfly, cricket, feather, and hamster pages

For an explanation of how to use these pages in the classroom, see "Parts of Animals Booklets" in the Life Science section of this manual. The feather pages that are labeled should not be reproduced for the children's use. These labeled pages should be mounted on cardboard, laminated or covered with plastic contact, and used as samples for children to copy.

Acorn-oak leaves and summer-fall pages

These two pages are part of a four-page booklet. See "Adopt-A-Tree" activities (#6) in the Life Science section of this manual.

Metric Droid pages

For an explanation of how to use these pages in the classroom, see "Metric Droid" and other metric measuring pages in the last section of this manual.

PLEASE NOTE

The pages in this "Materials Packet" are the only pages in this manual that may be reproduced without permission.

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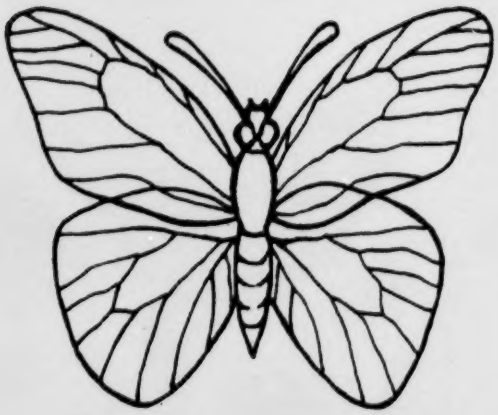
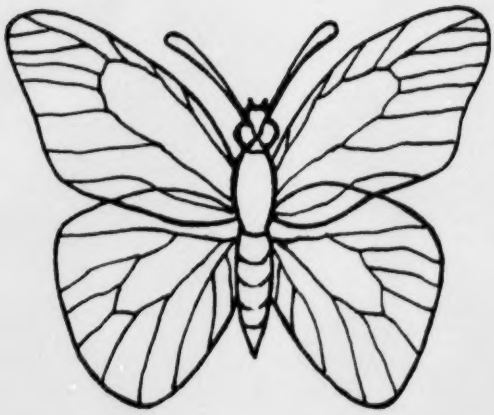
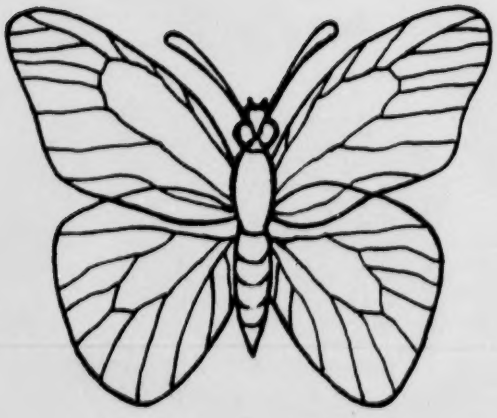
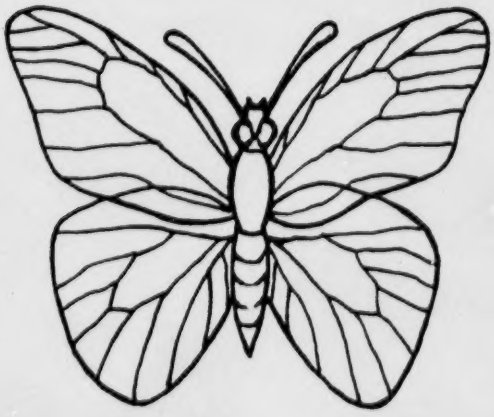
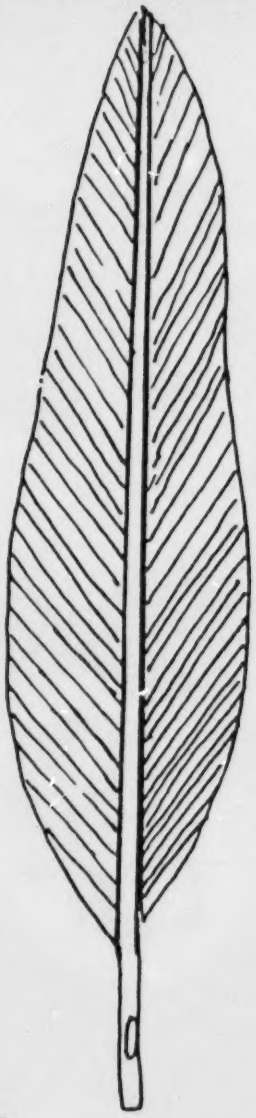




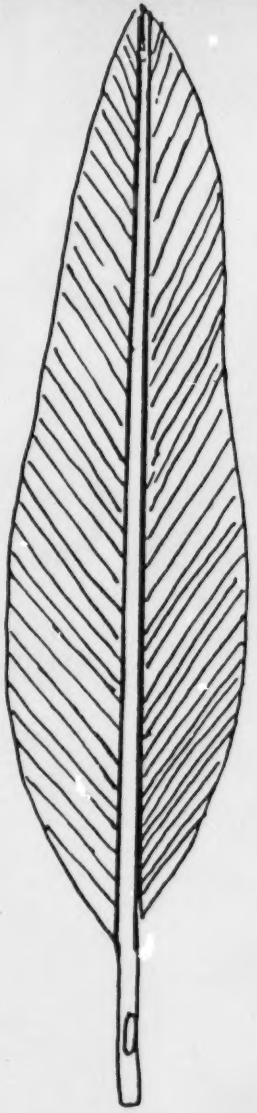






118

barbs



feather

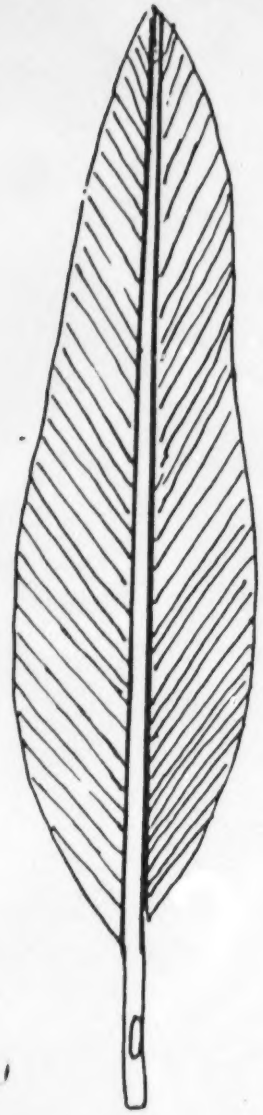
parts

of a

feather

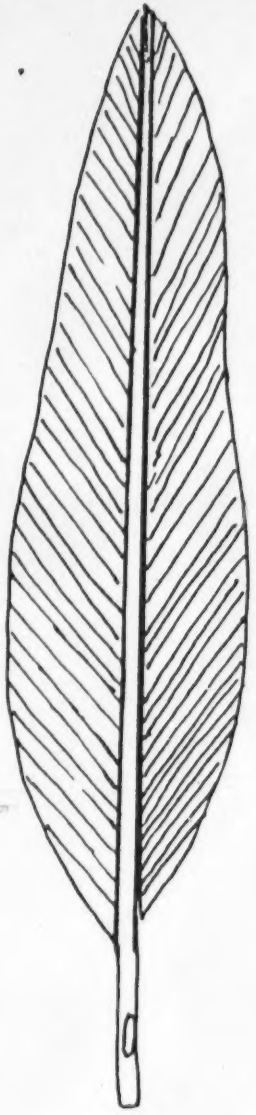
119

name

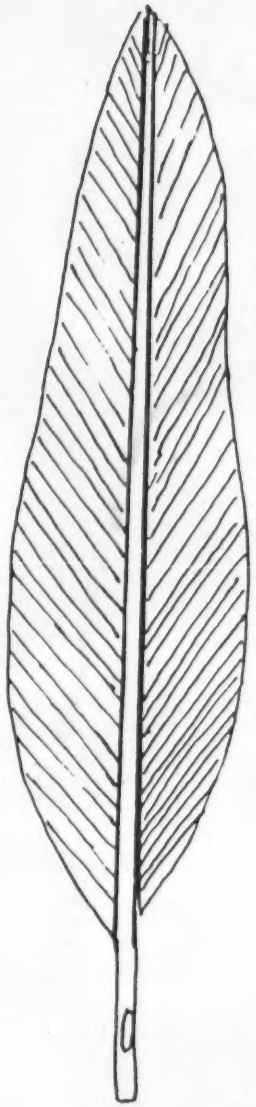


12a

vane

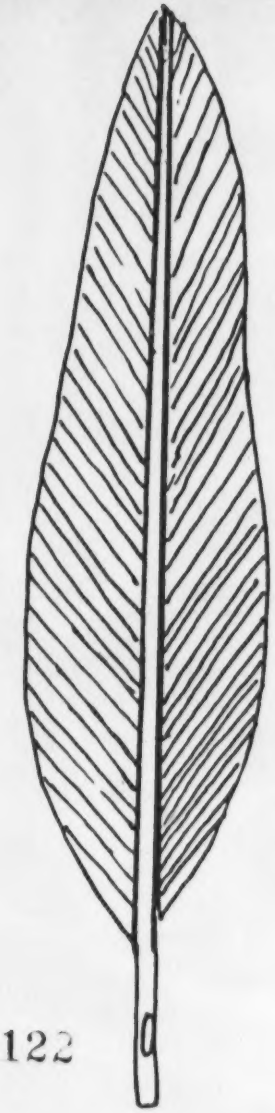


shaft



quill

12i



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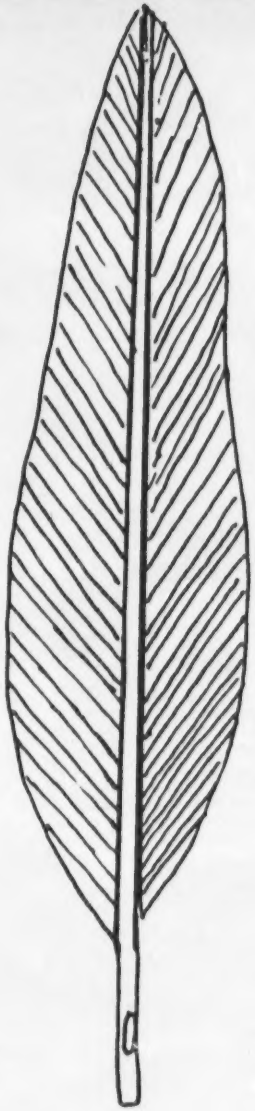


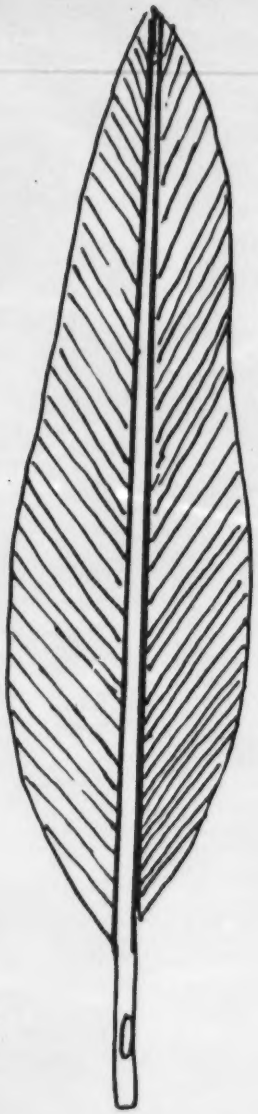
parts

of a

feather

123

name



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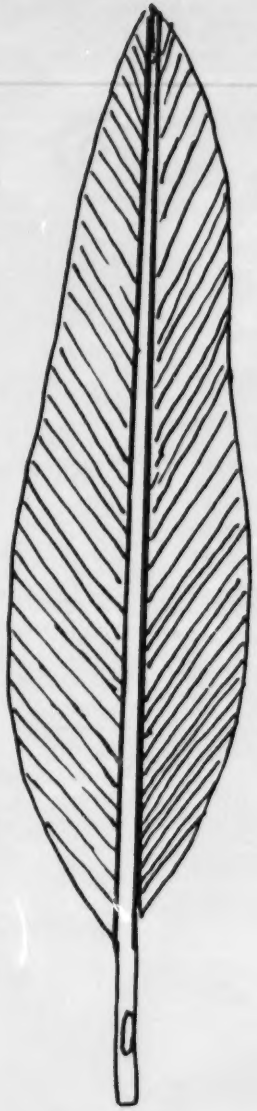
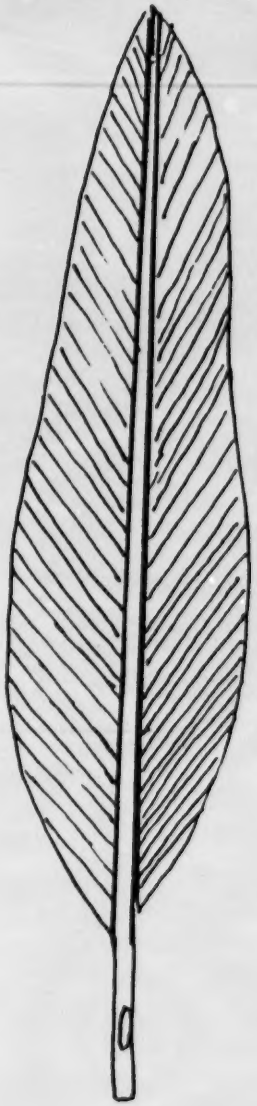




125

126

127

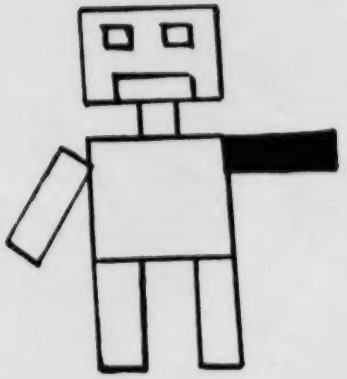
acorn

oak leaves

summer

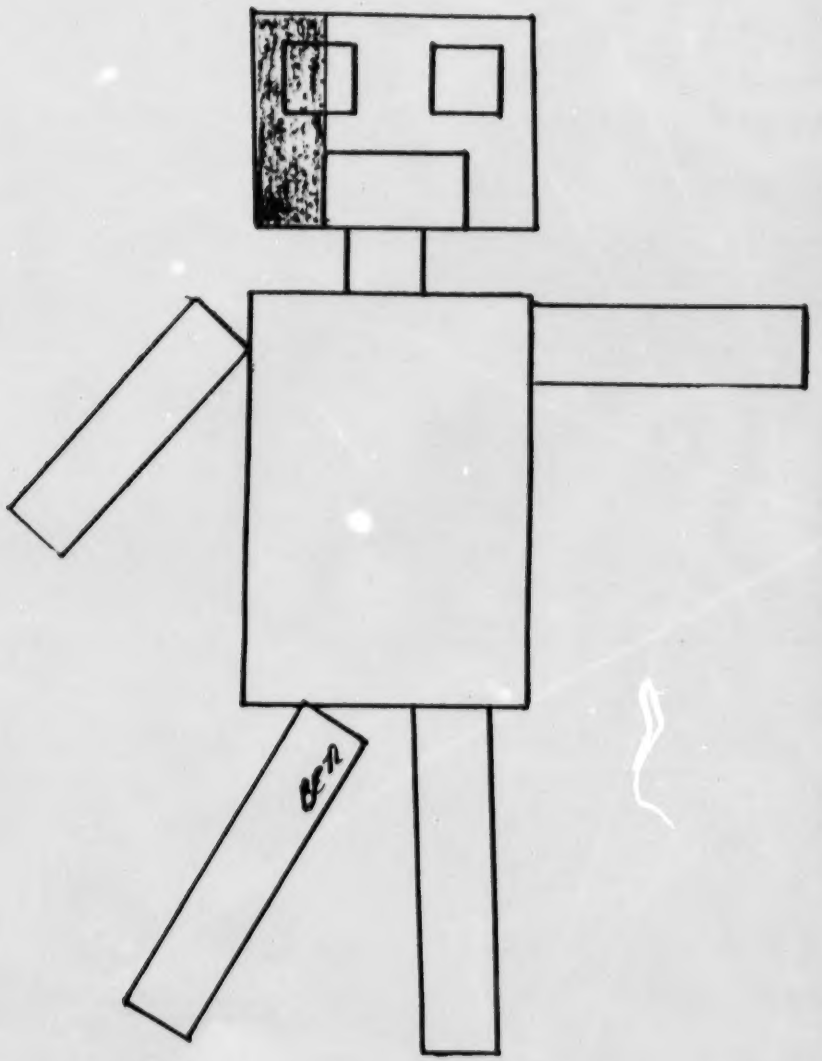
fall

Metric Droid

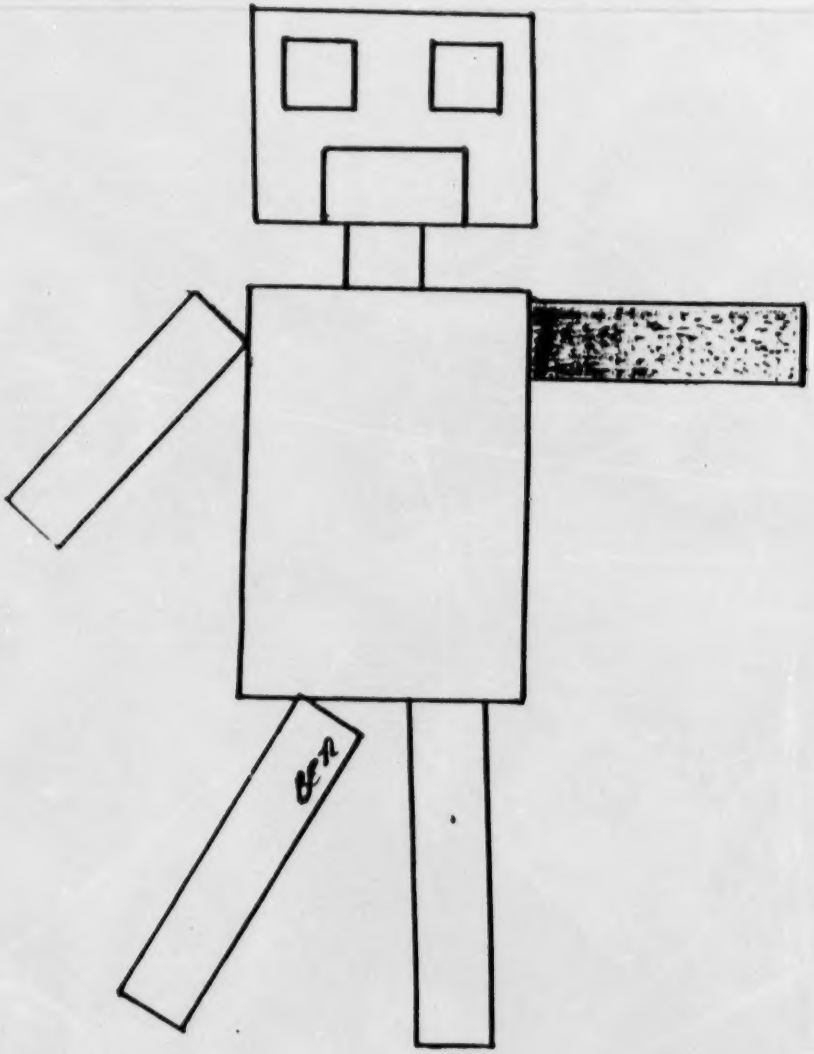


name

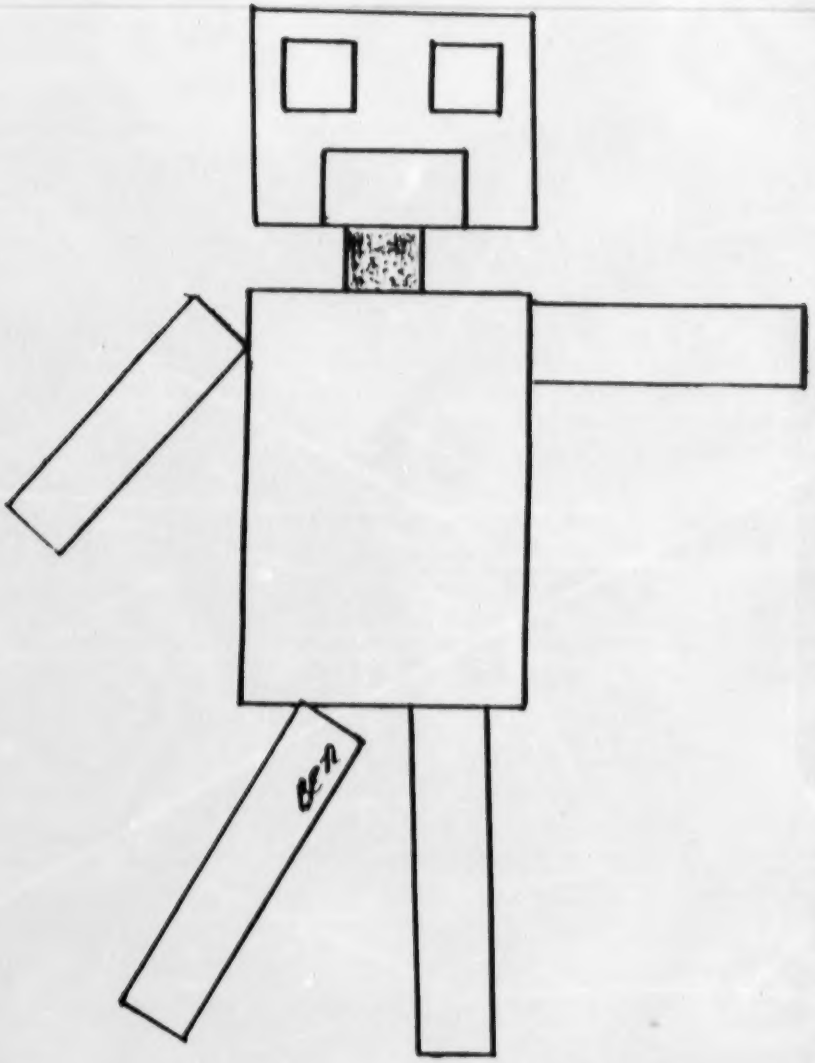
date



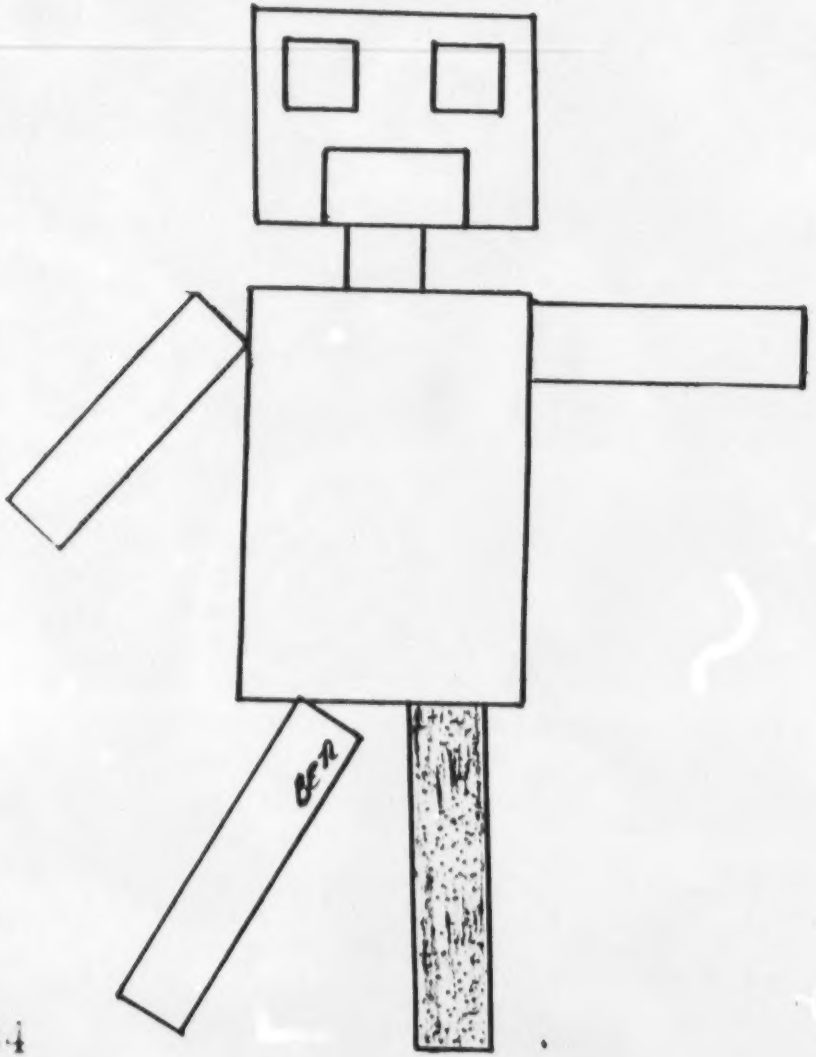
Its head is _____ centimeters long.



132 Its arm is _____ centimeters long.

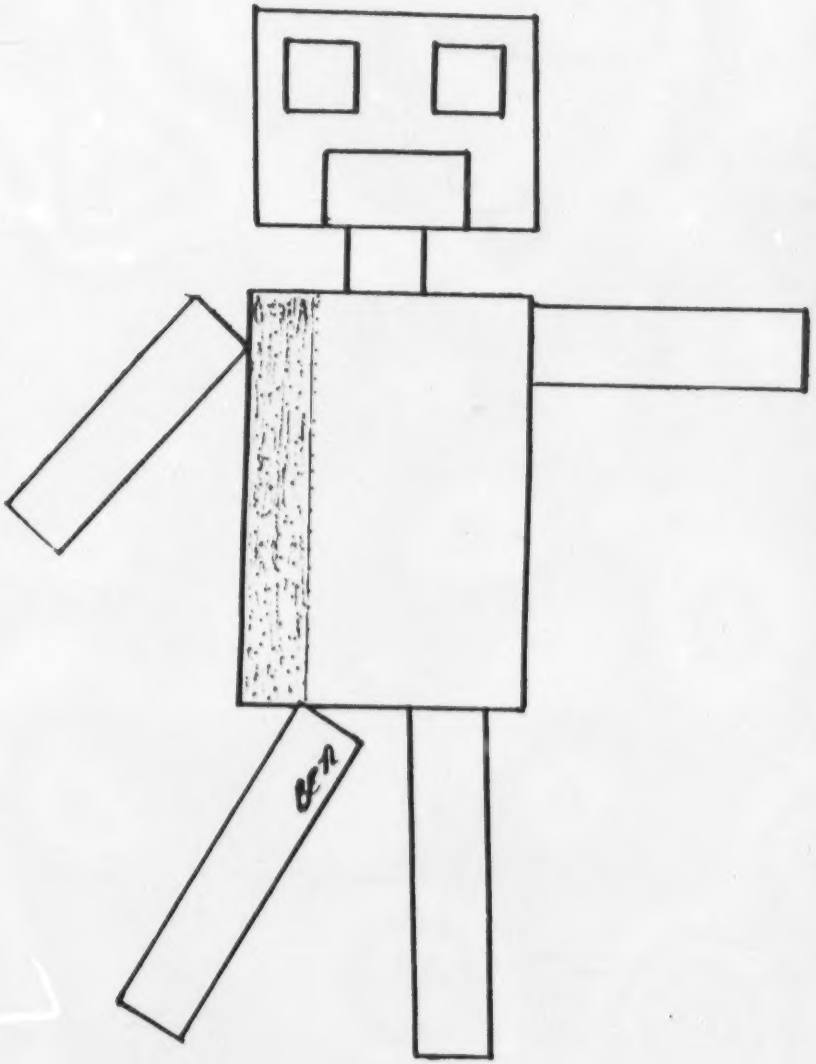


Its neck is _____ centimeters long. 133



134

Its leg is _____ centimeters long.



Its body is _____ centimeters long.